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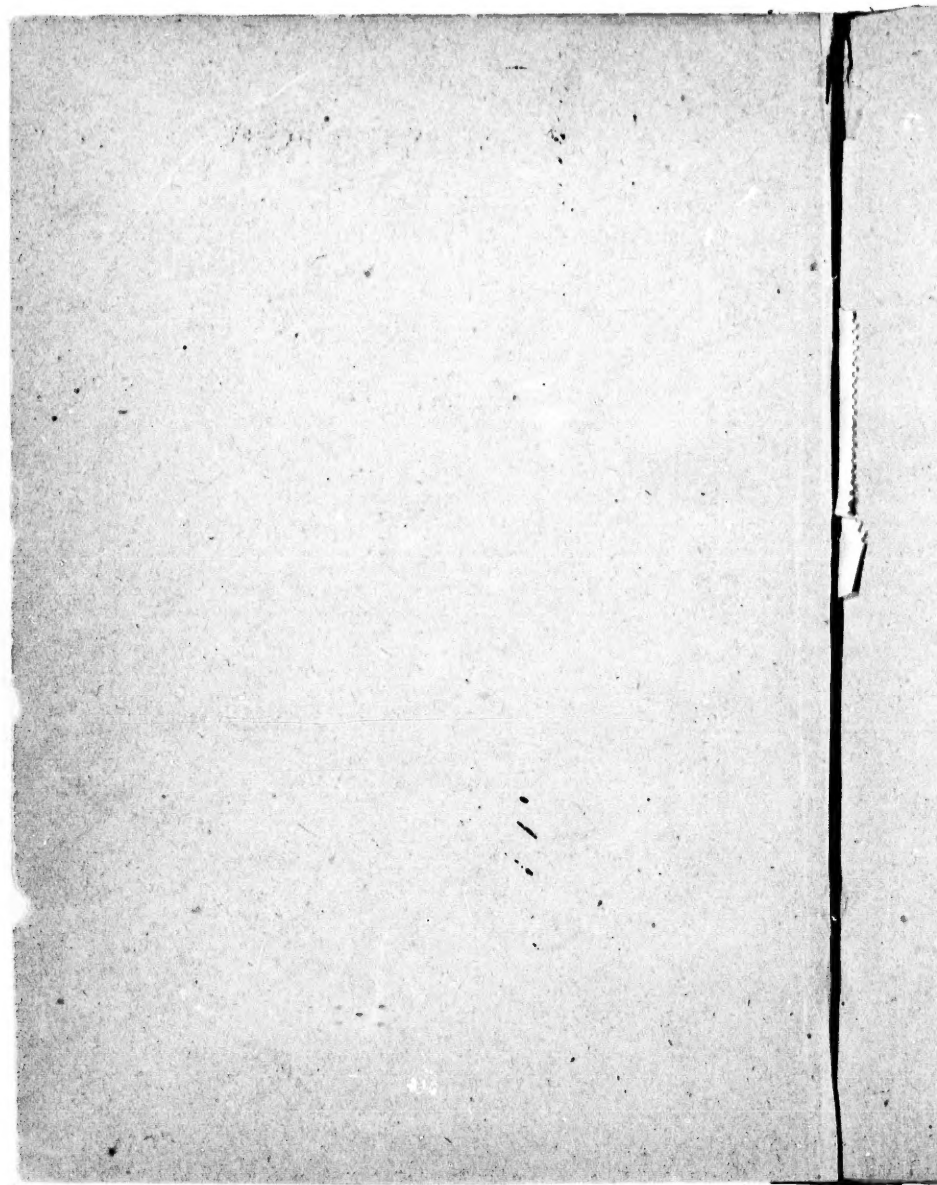
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SLEEP,
INSOMNIA, AND HYPNOTICS.

BY

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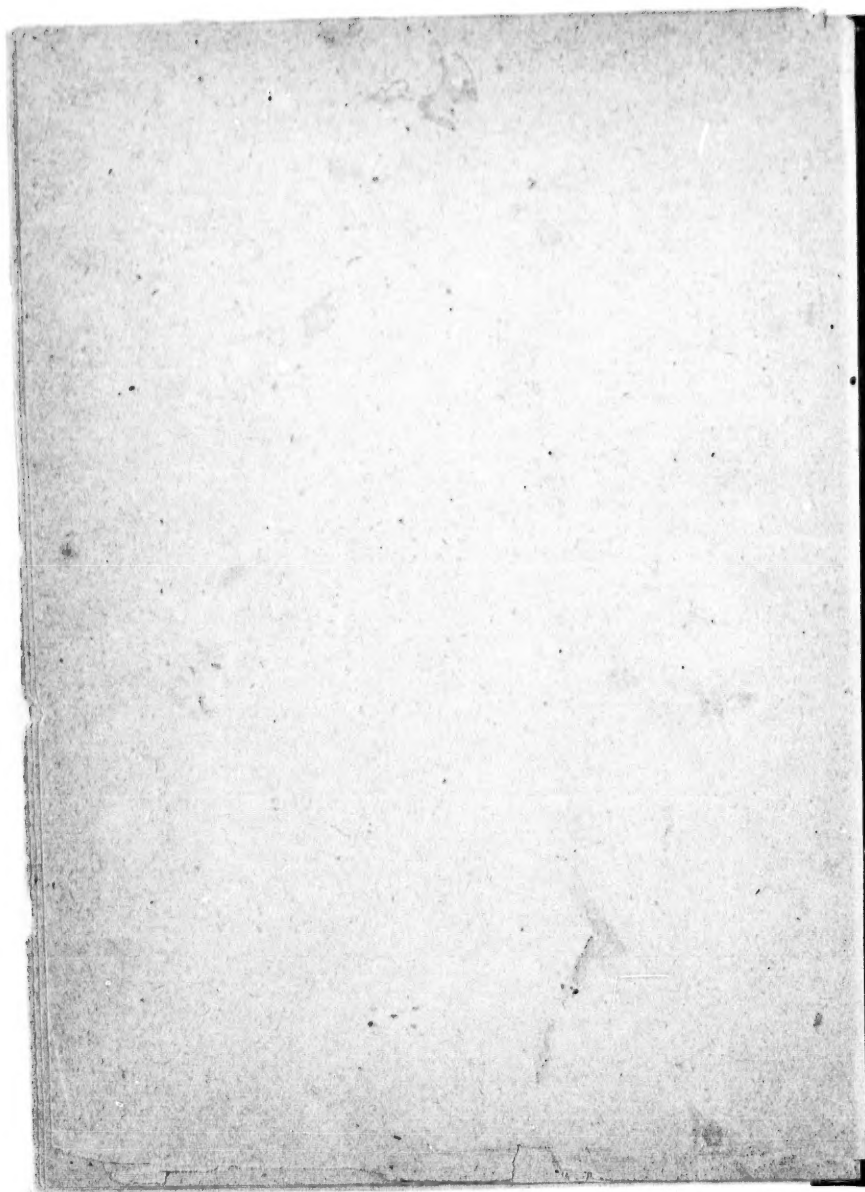
PREFACE.

This little treatise, though long advertised to be a translation of a recent monograph of Germain Sée in the *Médecine Moderne*, is in reality a product of my own pen, and whatever merit may belong to it, and all the faults and mistakes, must be credited to me. The monograph of Prof. Sée, with all its excellences, was found to be too brief and too incomplete for reproduction in the Leisure Library. A book on the subject had been promised, and the title announced, and I felt constrained to make good the announcement by my own endeavors; and all that I can say in palliation of my presumption in attempting to write a treatise on a subject which has been recently handled so ably by Macfarlane, is that the topic is one that has intensely interested me, that I have bestowed on it considerable independent thought, and that I have endeavored concisely to state, in a common sense and practical way, the questions presented. It will be found, moreover, that as long as medical subjects continue to attract the attention of mankind, so long will there be treatises written on Sleep and its phenomena, and attempts, scientifically, to explain these phenomena and remedy those conditions which give rise to that distressing infirmity of our modern life—Insomnia.

I desire in this place to state, once for all, that any coincidences between parts of this treatise and articles which have appeared during the past year in certain medical journals (the Therapeutic Gazette, the Boston Medical and Surgical Journal, the Medical Age) are explained by the fact that, in the preparation of this book, I have used material which I had previously contributed to the columns of those journals.

E. P. HURD, M.D.

Newburyport, Mass., Dec. 1st, 1891.



CHAPTER I.

THE PHYSIOLOGY OF SLEEP.

It has been sufficiently demonstrated that during sleep the brain is relatively anæmic. The observations of Durham, of Hammond, of Mosso, and others, have proved this. During sleep, all the encephalic blood-vessels are under a diminished pressure, as shown by the manometer. And this lessening of the active flow corresponds with a diminution of cerebral function. This is in accordance with the facts of physiology generally: the performance of function is characterized by vascular fulness and activity; the cessation of function is attended with decrease of the vascularity and volume of a part.

The immediate cause of sleep, however, is not simply the shutting off of a portion of the blood-current from the brain. The lessening of the blood-supply is rather the accompaniment than the cause of sleep. The true cause is the torpor—*engourdissement*—of the cerebral cells. This torpor may be the result of waste, unbalanced by repair, of the hemispherical ganglia, which become functionally inactive owing to diminution of oxidizing material, as well as to clogging of the venous and lymphatic channels by the accumulated debris of organic combustions.

But this is not all. As the effete products of cell function have a paralyzing action on the cells themselves—a truth exemplified even in the protoplasmic

life of microbes, which are now known to generate by their activity ptomaines that are microbicide—so the toxic theory of sleep, first propounded by Preyer, has much probability in its favor. Preyer thinks that lactic acid is one of the principal waste products whose retention in the blood causes sleep, and refers to experiments of his own where lactic acid was injected in the veins of animals and produced a deep somnolent condition which was undistinguishable from actual sleep. But lactic acid is only one of the toxic products of the living economy; the urinary salts are also destructive of cell life, and every cell is a laboratory of poisons,—leucomaines—which exercise their injurious effects on the organism as soon as the emunctories are incompetent thoroughly to perform their task of elimination. Bouchard, who has performed many interesting experiments on animals by injecting the urine of various physiological and pathological states, finds that the urine of the day possesses a toxicity twice as great as that of the night, and that the former produces narcosis, while the latter possesses convulsivant properties.*

From these experiments the inference is drawn that during the period of waking activity the processes of disassimilation give rise to products which by their accumulation cause sleep. And this accumulation takes place because the elimination of these substances by the urine goes on the more slowly the

* *La Médecine Moderne*, 1890, p. 183.

nearer we approach the usual period of sleep. On the other hand, during sleep, the convulsivant substances which result from denutrition coöperate in bringing about awakening.†

In accordance with this theory, it might be expected that there would be a definite relationship between the labor done and the amount of sleep required—that hard brain work would necessitate more sleep than muscular work, and that those who toil little would sleep little. Unfortunately, theories, like parables, do not always “go on all fours.” The relationship above spoken of is not mathematically established; the coal-heavers and diggers of the soil are the best, while the brain-workers are the poorest sleepers, and those that do little or no work of brain or muscle sometimes sleep with extraordinary soundness, and even have no difficulty in going to sleep in the daytime.

There is reason to believe that sleep often ensues from simple torpor or lethargy of the cerebral cells, a state into which some persons are constitutionally prone to lapse. The state of the fetus in utero may be regarded as one of continuous sleep, and it has been remarked that idiots and feeble-minded persons sleep much more than active-minded men.

THE NECESSITY OF SLEEP.—It is a law of nature that every kind of force or energy emanating from the organic or inorganic world shall be the exact equivalent of some pre-existent kind of force. This is the doctrine of the correlation and equivalence and persistence of force now universally admitted. The power that drives the piston rod of

† G. Sée, *loc cit.*

the steam engine existed latent in the coal as static force, originally coming in the form of dynamic force—light and heat—from the sun, that great primal source of power.

In the galvanic battery we see chemical force converted into electricity, and in the conducting wire we have the transformation of electric force into heat. In the organic world we witness the metamorphosis of light, heat and chemism into those forces which are called vital.*

*"It is now an admitted doctrine that the nervous power is generated from the action of nutriment supplied to the body, and is therefore of the class of forces having a common origin and capable of being mutually converted, including mechanical momentum, heat, electricity, magnetism, and chemical decomposition. * * * * What is called vitality is not a peculiar force, but a collection of the forces of inorganic matter in such a way as to keep up a living structure. * * * * The nerve force that is drawn from the waste of a given amount of food is capable of being transmitted into any other form of animal life. Poured into the muscles during violent conscious effort, it increases their activity; passing to the alimentary canal, it aids in the force of digestion; at other points, it is converted into sensible heat; while the same power is found capable of yielding true electrical currents. The evidence that establishes the common basis of mechanical and chemical force, heat and electricity, namely, their mutual convertibility and common origin, establishes the nerve force as a member of the same group."

—[Bain; Senses and Intellect, p. 65.

The life of the highest as well as the lowest organisms is characterized by the manifestation of certain activities

It is a truism to say that all organs that are exercised must have rest. After every considerable effort of the muscular system, a greater or less incapacity for further exertion results, and the subjective expression of this incapacity we call fatigue. The tired muscles obtain a measure of repair during the intervals of work, and such intervals may be frequent during the working hours. We often rest one set of muscles when we are working another set. Even those actions which are

derivable from the cosmic environment; the energy which we expend as nerve-force, muscular contraction, thought and will is but the expression of destructive changes taking place within our bodies. How much of nerve and muscular activity is the direct product of the breaking up of ternary compounds in the organism—fats, carbo-hydrates and glycogen, which are stored up as "reserves" in the tissues—how much is due to direct tissue metabolism, it is impossible to say; it is certain, however, that parts of the body that undergo exercise waste *pari passu* with that exercise, and that in undergoing disintegration, the static force that gave them structural form and function is set free as dynamical energy, and in accordance with the substratum throughout which it is liberated, manifests itself as some form of vital force.

Plants expend little motion, and consequently their waste is inappreciable. Actinæ kept in an aquarium diminish little in bulk from prolonged abstinence. Even fish, which are much more active than other aquatic creatures, suffer little loss of substance when kept long unfed. The same remark applies with greater pertinency to cold-blooded animals and to hibernating animals. On the contrary, warm-blooded animals in a state of normal activity expend much energy and

most continuous, as respiration and the pulsations of the heart, have distinct periods of suspension. It is a mistake to suppose that the heart and lungs never rest. After each contraction and dilatation of the heart, as Hammond reminds us, there is a pause of one-fourth the time of a beat in which the heart rests and is repaired. Hence the heart may be said to rest six hours out of the twenty-four. After each respiratory act, there is a pause equal to one-third of the whole time; thus the lungs rest eight hours out of the twenty-four. But for the busy brain, there are no sufficient seasons for rest during the working hours. The latest, most elaborate, most noble product of evolution, superadded to the spinal and sensory ganglia of the animal economy ages after the automatic action of these centres had been established by

waste much substance.† This waste must be made good by repair, and the conditions of repair are a normal supply of food, a normal circulation, and opportunity for appropriation of pabulum. If this opportunity be not afforded from moment to moment; if synchronous with waste, repair cannot go on, suitable seasons must ensue when the equilibrium may be restored. If the system cannot in its entirety be refected while work is going on, work must stop while the system is being refected. The machine is out of repair, and business must be suspended while it is having an overhauling. These considerations give hints as to the true meaning of sleep.

† Vide Herbert Spencer's *Principles of Biology*, Vol. 1, p. 170, from which I have borrowed several illustrations of the law stated. The only satisfactory explanation of the phenomenon of sleep is furnished by such biological inductions.

organization, and superadded for the greater elaboration of faculty and for the more complete co-ordination of faculty with the conditions of existence, the cerebrum is still the latest development in the evolution of the individual, and perhaps the most heterogeneous and unstable in its molecular constitution.

I do not propose to go into any lengthy consideration of the functions of the brain. I assume the cerebrum to be the seat of sensation, thought, volition. The psycho-motor centres are located in the post-frontal and parietal regions. No such precise localization for the purely psychical centres is yet possible. "The endless variety in the character and complexity of our cerebral activities," says Macfarlane, "implies the existence of a like multiplicity of centres." Localization we do indeed know in part. Ferrier's teachings with regard to the motor centres for the muscular groupings of the face, upper and lower extremities, etc. (which are mostly located along the fissure of Rolando), are generally accepted. The visual centre is in the occipito-angular region; the auditory is in the temporo-sphenoidal convolutions. The seat of smell is probably in the tip of the temporo-sphenoidal lobe, that of taste is in the region of the *subiculum cornu ammonis*.

The seat of cutaneous sensation—tactile, thermic, pathic—located by Ferrier in the gyrus hippocampi and gyrus fornicatus, seems the rather, in accordance

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with a multitude of facts collected by Dana,* to be in the motor areas of the cortex. A study of cases shows that the the sensory centres for special parts of the body, *i. e.*, face, arm, or leg, are in general identical with the motor centres for those parts, but are larger and more diffuse. The tactile sensation seems to be more strictly confined to the motor areas.†

The centres of the psychical operations are known to be somewhere in the cortex, but apart from the general vague division of mind into feeling, intellect, and volition, and the recognition of the fact that these three aspects of mind are so dependent among themselves, although characteristic in their manifestations that no one could exist alone, no further division of mind is possible in the present state of science.

There is, however, a sort of psychical differentiation with definite localization of which we are warranted in speaking, and as the subject is of importance in connection with the physiology of sleep, I may be pardoned such digression as may be necessary to set forth views which may now be considered as data of science.

Ribot, in his "Diseases of Memory," remarks that in physiology the distinction of partial memories is now currently received. "Memory resolves itself into memories, just as the life of an organism resolves

* "The Cortical Localization of the Cutaneous Sensations," *Journal of Mental Diseases*, Oct., 1888.

† Dana, *loc cit.*

itself into the life of the organs, tissues, and anatomical elements that compose it."

As memory is only the sum of partial memories, and all our knowledge (based on memory) is primarily derived through the senses, and as all the sense-organs have their centres in the cerebrum where the residua of sensations (to use Maudsley's expression) constitute the memories of each special sense, so certain diseased conditions may obliterate one set of sense-memories by destroying their anatomical substrata, leaving, it may be, intact the memories of other senses.

Charcot, in a recent lecture, has given us a good instance of this suppression of certain groups of memories. It was a case of loss of the mental vision of objects—forms and colors—coming on suddenly in a subject noted for great intellectual activity, but especially for the strength of his visual memory. This individual would recall the principal features of a landscape, a painting, a play, with extraordinary exactness and vividness; his imagination was keen, and he excelled in perspective. He could readily recall what he had read by the mental images of words, lines, sentences, etc., presenting themselves. His memory of persons and places was wonderful. After the accident to which allusion has been made, and which seems to have been of the nature of a limited embolism, he lost his visual memory of forms and colors, and was obliged in the management of his commercial affairs to have recourse to other forms of memory (the auditive, tactual, etc.), which were unimpaired. The city where he lived, his very home, and the faces and forms of the members of his family were at first strange to him; he recognized nobody except by the voice; he could only find his place of

business by inquiry. Little by little his visual memories returned, but never completely. He had lost the faculty of drawing; could no longer sketch the form of any object which he had once seen. His memory of colors was gone; he could not form the mental image of black, white, red, etc., and when anything of a bright hue was presented to him, he could not recognize the color. The larger part of what he had learned by reading was forgotten, while the memory of what had been acquired by the auditory sense was as vivid as ever.

This gentleman wrote to Charcot that his "interior vision," once so active and perfect, "had completely disappeared." He could no longer represent to himself the forms and features of his wife and children, or any other person or object with which he had been familiar. His dreams were completely changed; he now no longer dreamed of persons and places, but of voices and words. A remarkable consequence of the loss of this mental faculty was the change of character which he had experienced. He found himself much less prone to sorrow, sympathy and moral emotion than formerly. Having recently lost a valued relative, he felt much less poignant grief than we would have felt could he have represented to himself by the interior vision the physiognomy of this relative, the phases of the disease through which he had passed, and especially, if he could have pictured to himself the external effect produced by this death on the members of his family. He concludes his letter by the remark that he is now obliged to say to himself the things which he wishes to retain in his memory, whereas, before the occurrence of his cerebral lesion, he had only to *photograph them by sight* in order to remember them.

Charcot concludes some very judicious and instructive comments on this interesting case, of whose details we have given but an imperfect idea, by the following observations: "It cannot now be denied that the possible and actual suppression, in numerous instances, of an entire group of memories, of a whole category of commemorative images, without the participation of other groups, of other categories, is a capital fact in pathology as well as in cerebral physiology; it leads necessarily to the admission that these divers groups of memories have their seat in certain determined regions of the encephalon, and adds another proof to those already existing that the hemispheres of the cerebrum consist of a certain number of differentiated organs, of which each possesses its proper function, while remaining in the most intimate connection with the others. This last proposition is, moreover, to-day generally admitted by those who study the functions of the brain, not only in animals, in the laboratory, but also, and especially, in man, by the procedures of the anatomo-clinical method."

To sum up, then, the cerebrum is the great centre of sensation, perception, and ideation, of conscious, emotional, voluntary activity. Pulses of molecular motion from the brain are being continually diffused throughout the body, and the healthy performance of its office by every part of the body depends largely on these gushes of nervous energy. There are differences in molecular activity between nerve fibres and nerve cells. "While the matter composing a cell is built up of enormously complex aggregates of molecules, wholly unshielded from ex-

ternal disturbance, the nerve matter of a fibre is protected throughout its entire length by a membranous sheath. And while it is probable that the action going on in a cell consists in the continual fall of unstably arranged molecules into a state of more stable equilibrium, from which a fresh rush of blood is continually raising them to their unstable state, it is probable that the action going on in a fibre consists in the successive isomeric transformation and retransformation of the system of molecules which make up the fibre." "The cell is the place where nervous energy is liberated, while the fibre is a path along which nervous energy is transmitted."*

The amount of molecular energy locked up in a nerve centre is proportionate to the amount of unstable nerve matter awaiting decomposition; and the

* This view is well brought out by Virchow. He believes that all function (or activity of all kinds in tissues) is due to changes of place in the minute particles of the cell contents. This change of place is almost instantaneously transmitted through all the cells in proximity. A change in the electrical state of the part is connected with it. Virchow's view that restitution of function does not always depend on a fresh absorption of nutritive material may perhaps seem novel. Rest alone, he says, is often sufficient to enable the cells in a very short space of time to renew their activity. The molecules which had quitted their usual position gradually revert to it, and hence are ready for function again. Virchow seems to have proved this by experiments on nerves which have been cut out of the body.—[Cellular Pathology, p. 327.]

greater the quantity of motion liberated, the less of material remains for the liberation of motion.* Hence the diminished readiness with which the nervous centres respond to stimuli after a few repetitions of the disturbance. The amount of explosive material is lessened with each explosion. The enfeeblement of nerve-centres when caused by moderate action is inconspicuous, for the disintegrated mass speedily re-integrates itself from the materials brought in the blood.† But if the stimulation and consequent discharge are violent, or very often repeated, then repair falls so far in arrear of waste that the nerve centres become partially or completely incapacitated. "All the unstable substance within easy reach of the incoming disturbance has been decomposed, leaving only such part as is most removed from ordinary disturbances and can be affected only by excessive ones." As examples we need only to be reminded of the tired horse that needs persistent urging and the continued and often excessive use of the lash to make him continue his pace. Also of the effect of friction of the skin in causing paralysis of the vaso-motor nerves and cutaneous congestion. The familiar experiment of the effect of irritating the web of the frog's foot is to the point. The arteries are at first contracted under the stimulus; "the strong impression conveyed to the vaso-motor centres there liberates an excessive dis-

* Spencer's Psychology, vol. 1, p. 89.

† Herbert Spencer, *loc. cit.*, p. 89.

charge along the fibres supplying those arteries, causing spasmodic contraction of their muscular coats. The second result is that these arteries dilate, losing their normal contractility; they become distended with blood, and the part is congested. That this is due to extreme prostration or temporary paralysis of the vaso-motor centre has been clearly proved, for if the nerve-trunk containing the vaso-motor fibres be dissected out and artificially irritated, the dilated arteries instantly contract."*

Mr. Herbert Spencer, from whom I have borrowed these illustrations respecting the vaso-motor nerves, has hardly done more than gather up into a complete whole the generalizations of his leading scientific contemporaries. Virchow, for example, in his Cellular Pathology, p. 149, has said substantially the same respecting the action of vaso-motor nerves under stimulation, and the readiness with which they are exhausted. In the smaller vessels, with few muscular fibres, the exhaustion follows so speedily the stimulation that it seems as if the irritant had produced no contraction, so soon does relaxation follow.

These familiar truths explain why the brain needs the rest of the night. Repair and waste are not evenly balanced during the waking hours. Waste has got in excess of repair. Not that no repair has been going on during the working hours—nutrition is actively going on at all times, and in the spinal cord

* *Loc. cit.*, p. 87.

and medulla oblongata it is probable that repair ever keeps pace with waste, or falls but little in arrear, equilibrium being quickly restored. The peculiar functions of these lower centres are of an automatic kind, stimuli always producing responsive discharges along established lines. It would certainly be for the advantage of every species in the struggle for existence that those automatic functions should be performed at such an even, uniform rate that repair and waste should be in equilibrium. Such is the condition of these nerve centres. From minute to minute brief pauses occur, when waste is made good by repair. This was shown to be true in respect to respiration, the pause after each respiratory act giving the bulb sufficient time for repose and repair.

With the cerebrum the case is somewhat different. "Its substance is consumed by every thought, by every action of the will, by every sound that is heard, by every object that is seen, by every substance that is touched, by every odor that is smelled, by every painful or pleasurable sensation, and so on. Each instant of our lives witnesses the decay of some portion of its mass, and the formation of new material to take its place."*

Hence the need of that periodical repose we call sleep. Sleep becomes emphatically "tired Nature's sweet restorer," "balm of hurt minds," "chief nour-

* Hammond, "Sleep and its Derangements," p. 12.

isher in life's feast." In this adaptation of organisms to the waste of the day and the repair of the night, Herbert Spencer sees an example of the principle of survival of the fittest. "An animal so constituted that waste and repair were balanced from moment to moment throughout the twenty-four hours, would, other things being equal, be overcome by an enemy or competitor that would evolve greater energy during the hours when light facilitates action, at the expense of being less energetic during the hours of darkness and concealment. Hence there has necessarily established itself that rhythmical variation in nervous activity which we see in sleep and waking." (Principles of Psychology, vol. i, p. 88).

Antecedents of Sleep.—There is every reason to believe that one of the antecedents of sleep is a certain change in the composition of the blood circulating in the capillaries of the pia mater, where by the nutrition of the cortical cells is diminished. This change may be regarded as an accumulation of waste extractives. There is also doubtless another factor, as stated by Pflüger; the brain is extremely sensitive to the want of oxygen, *e.g.*, when frogs are deprived of this element for any length of time, they fall into a condition resembling sleep. Some experiments of Pettenkofer and Voit make it apparent that oxygen accumulates in the blood during sleep to be utilized during the waking hours; deficiency or absence of this "change-compelling" element may well cause

that lethargy of function whose full expression is sleep.*

Another antecedent of sleep is lethargy of the circulation. There are probably several factors in this change. Less blood is attracted to the cortex by the cells becoming functionally inactive, and the tired brain sends diminished energy to the heart, and there is a slowing of the circulation. With a diminution of vaso-dilator influence in the higher ganglia there may be an augmentation of vaso-dilator influence in automatic ganglia lower down (the inhibitory agency of the hemispheres being withdrawn), hence a narrowing of the calibre of the cerebral arterioles and a lessened blood supply. During sleep, then, it is believed that the proper functions of the cerebrum are mostly suspended, nutrition only being active; the constricted arterioles supplying just enough blood to the nerve cells that the requisite reparative processes may be performed.

* These experimenters, by an ingenious laboratory contrivance, were enabled to measure the amount of oxygen inhaled and of carbonic acid exhaled during the 24 hours. A healthy man was put into the test chambers with the light occupation of taking to pieces the works of a watch. Of the total quantity of oxygen inhaled by him, 33 per cent. was absorbed during the day, and about double, 67 per cent., during the night. This goes far to prove that night is the time for storing up oxygen to be used during the day in the production of work.—[North British Review, June, 1868, p. 269.]

This relatively anæmic condition of the cerebrum during sleep has been proved by numerous well attested observations, as those of Sir Astley Cooper, Pierquin, Donders, Durham, Hammond, Mosso, and others. The experiments of Hammond were made on dogs from whose crania portions of bone were trephined, exposing the brain and its membranes. The details of these experiments are now sufficiently known since their publication in his book on "Sleep and its Derangements." Durham's observations, which were several years prior to Hammond's, also pertained to dogs.

Pierquin's case is recorded by Dendy in his "Philosophy of Mystery," and elsewhere.* A girl in Montpellier had lost a large portion of her scalp and skull. The brain could be seen for a considerable extent of surface. When she was in dreamless sleep, her brain was motionless and low within the cranium; but when her sleep was imperfect and she was agitated with dreams the cerebrum moved and beat; more blood coursed through the vessels of the pia mater, and the brain protruded through the holes in the skull. * * * When she was awake and in vigorous thought, the brain swelled, and protrusion was very observable.

Professor Mosso, of Turin, had the rare opportunity of making similar observations on three persons, each of whom had lost a portion of the skull. His studies of the cerebral circulation during sleep

* Combe's Physiology, p. 143. Jarvis' Physiology, p. 432. American Annals of Phrenology, No. 1, p. 37.

and during the waking moments have been the most thorough, and go to show: "1. That in the act of going to sleep a dilatation and relaxation of the vessels of the forearm occur, with a corresponding contraction in the vessels of the brain, this change becoming most pronounced during deep sleep. 2. That all external stimulation, however slight, such as a ray of light falling upon the eye, a noise, etc., is attended by contraction of the vessels of the forearm, greater blood pressure, and an increased flow of blood to the brain. 3. That these changes are accompanied by a modification of the respiratory rhythm, and an acceleration of the pulsations of the heart. 4. That during sleep, the quantity of blood in the brain is subject to fluctuation without any apparent cause. 5. That all mental activity is attended by an increased quantity of blood in the brain." *

These facts seem to teach that the sleep state is attended with relative anæmia of the brain, and that the amount of blood supply to that organ is in ratio with the mental activity.

Hammond regards this diminution of the quantity of blood circulating in the brain as the *immediate* cause of sleep, and affirms that whatever cause is

* "Insomnia and its Therapeutics," Macfarlane, p. 16. Mosso devised special instruments by which he took tracings of the movements of the brain, the pulsations of the heart, etc.; he also invented the Plethysmograph, for estimating the quantity of blood in the forearm and hand.

capable of lessening the quantity of blood in the brain is also capable of inducing sleep.

To this view has been opposed the fact that patients suffering from general anæmia (from hæmorrhage, chlorosis, cachexia, etc.), are often the victims of insomnia, and that conditions of plethora are often attended with troublesome somnolence. Ligature of the carotids in animals does not produce a state resembling true sleep, and faradization of the cephalic ends of the two divided cervical sympathetic cords in animals, while it produces considerable cerebral anæmia, does not bring about the least tendency to somnolence.*

These objections appear to me to be well taken, and it seems probable that the vascular and cardiac modifications are, as Vulpian says, "only accessory and adjuvant," "concomitant or consecutive, playing no essential rôle in the physiology of sleep."

At the same time, there is no doubt that "slight and gradual anæmia of the brain is conducive to sleep," and therefore we see the utility, in some cases of insomnia, of hot pediluvia, cold, wet cloths to the head, etc.

The Sense of Fatigue.—Subjectively, sleep is preceded by a sense of fatigue, which is the more pronounced the greater the labor which has produced it. Fatigue may be regarded as an expression of waste

*See these objections forcibly stated by Vulpian in his *Leçons sur l'Appareil Vaso-Moteur*, t. I, p. 150.

unbalanced by repair; according to Preyer, lactic acid and creatine accumulating in the blood cause this sensation by their paralyzing action on the cells of the cortex.

"Fatigue," says Benedikt,* "is a property inherent in all the nervous and muscular tissues; but the almost unlimited duration of certain automatic movements of pathological nature proves that the fatigue which supervenes after voluntary movements has its origin in the motor centers of the cortex. * * * * The sensation of fatigue is in a certain sense a guaranty of safety for the muscular apparatus. In certain pathological states, often even by the energy of the will alone it may be overcome. But there then follows a still greater realization of fatigue, which may be the result of complete exhaustion."

Normal fatigue easily leads on to a condition of sluggishness and languor known as sleepiness. The eyelids feel heavy, the muscles relax, there is an instinctive disposition to shirk work, an inability to fix the attention on anything which requires thought, a sensation of supineness and enervation, a considerable obtuseness of the senses. Yawning is a phenomenon "indicative of a wearied attention." "The head nods and droops upon the breast, and the body assumes that position which is most conducive to ease, comfort, and entire muscular inactivity."

Another subjective antecedent of sleep is failure

**La Médecine Moderne*, 1891, p. 67.

of the attention. To this end, absence of sensorial impressions is an important condition of sleep. There are certain influences which are predisposing causes, such as darkness and silence and muscular rest. Habitual sensations, as the continuance of an accustomed sound, are of the same class. It is owing to the power of habit that some persons can sleep more soundly in the neighborhood of noisy mills and cataracts, than elsewhere, the attention of the individual being more attracted by the suspension of the sound than by its continuance; for as the exercise of the attention implies an awakened and concentrated consciousness, during such exercise sleep is, in the nature of the case, impossible. Other predisposing causes are gentle tranquillizing sounds, such as the piping of crickets, the rustling of foliage, the hum of bees, hearing a dull book read, etc., which conduce to sleep by making on the sensorium a series of monotonous impressions which are neither interesting enough, nor powerful enough to keep the attention aroused (Carpenter).

Ovid places the cave of Somnus in the country of the Cimmerians, the fabled land of shadows, of silence, and of gloom. The river of Lethe flows there, and invites to sleep by its murmur, and poppies luxuriate before the cave of the drowsy god. Spencer locates the palace of Somnus in a dull and darkling part of the earth. Archimago sends a little spirit down to Morpheus to fetch him a dream:

" He making speedy way through spersed ayre,
And through the world of waters wide and deep,
To Morpheus' house doth hastily repaire
Amid the bowels of the earth full steepe,
And low, where dawning day doth never peepe,
His dwelling is. There Tethys his wet bed
Doth ever lave, and Cynthia still doth steepe
In silver dew his ever drooping head,
While sad night over him her mantle still doth spreade.
And more, to lull him in his slumber soft,
A trickling stream from high rock tumbling down,
And ever drizzling rain upon the loft,
Mixed with the murmuring wind, much like the sounne
Of swarming bees did cast him in a swoone,
No other noise, nor people's troublous cries,
As still are wont to alarm the walled towne,
Might then be heard, but Careless Quiet lies
Wrapped in eternal silence far from enemies."

Amount of Sleep Necessary.—As sleep is a constructive process, it would seem that the amount of sleep taken should be proportionate to the mental and physical exercise of the waking hours. The reparative value of sleep, however, is more dependent on the depth and intensity of the sleep than on its duration. The invigoration which follows sound, dreamless sleep is remarked by every one; a little sleep of this kind is worth many hours of disturbed, dreamy sleep. It would seem that absolute quiescence and suspension of function is that condition of the cortical cells most favorable for nutrition and repair. The principle of making up for lost sleep is a correct one; persons habituated to six or seven

hours' sleep a day may pass without inconvenience a night or two without sleep, provided they can make up for this loss by a more prolonged sleep afterwards. It is by dint of the habit of sleeping profoundly when they do sleep, that some persons sleep but few hours out of the twenty-four, and yet continue in health. Frederick the Great and John Hunter are said to have required only five hours' sleep a day; Pitt used to restrict himself to three hours. The briefest sleepers are generally men of the greatest mental activity. The best scholars, thinkers and literary men, according to Carpenter, do not spend more than one-fourth of the diurnal cycle in sleep.

Persons of lymphatic temperament are said to be the greatest sleepers, from natural lethargy of the nervous centers.

Hard, muscular toil promotes somnolence more than hard brain-work; the husbandman and day laborer sleep longer and more profoundly than the student or professional man. The waking state of such persons is characterized by great activity; the wear and tear of the muscular system is immense, and long seasons of rest are needed, during which the physical and vital energies shall be largely occupied with the work of muscular reparation. Blood goes from the brain to the muscle, and there is relative anæmia of the cortex, a condition favorable to the inertia of sleep. Moreover, the cerebral activity of even the humblest day laborer is not inconsider-

able—the sensory, perceptive, and voluntary faculties are kept constantly employed during their daily occupations. They often toil for hours in obedience to a painful exercise of the will, amid an almost overpowering sense of muscular weariness. Now, a purely voluntary act fatigues the brain more than an involuntary or automatic one. Hence, the protracted sleep of the day laborer must be due in a considerable degree to cerebral waste.

The relationship of muscular exercise and muscular fatigue to the intra-cranial energies and circulation may not be demonstrably clear, but the fact is none the less certain that muscular exertion is one of the most powerful promoters of sound sleep.

Dreams.—Dreams, from a psychological point of view, constitute the most interesting phenomena connected with sleep; from a medico-physiological point of view, they are chiefly of interest as indicating that the sleep is not sound, *i. e.*, only partial. In dreams, the cerebrum is in part awake; the automatic (earliest evolved, most organized) centres of mind resume a measure of their activity, while the will* is still dor-

* I use the term as expressive of the sum of the higher mental activities. These may be regarded as the latest evolved, most consummate results of evolution—the last developed in individual biological history and the soonest lost. The effects of physical tire earliest manifest themselves in modifications of the functional efficiency of the organic substrata of these faculties; the truly automatic substrata are more stable and capable of more prolonged, unresting

mant. A limited area of brain is brought into a condition of waking excitement; certain ideas and emotions result, which, not being modified by comparison, and reflection by other ideas and feelings which are asleep, present a phantasmagorical succession of images to the consciousness.

Hammond suggests that the cause of that suspension of the judgment which characterizes sleep resides in some alteration in the circulation of the blood in that part of the brain which presides over the judgment, whereby its power is suspended and the imagination left free to fill the mind with its incongruous and fantastic images.

And yet, judgment, like volition, is a very complex phenomenon. It implies the possession of one's principal mental acquisitions, one's stores of experiences; it implies comparison, choice. The experiences themselves may not be actually present to the consciousness, but certain *residua*—unconscious generalizations—from these experiences, must be there that judgment may be exercised on the case at issue. It is plain that the imperfect sleep consciousness is inadequate to such exercise of comparison.

We have not time to linger on this interesting topic covering which volumes have been written. It is perhaps better to leave this domain to the poet and

activity, as is shown by abundance of pathological facts. (See Hughlings Jackson's Lectures on Evolution and Dissolution in the Nervous Centres.)

the metaphysician, to whom, as rightful property, dreams belong. We may remark, in passing, that the loss of association of ideas prevails as much in dreams as in the waking state.

"Lulled in the countless chambers of the brain
Our thoughts are linked by many a hidden chain.
Awake but one, and lo! what myriads rise,
Each stamps its image as the other flies.
Each thrills the seat of sense, that sacred source
Whence the firm nerves direct their mazy course,
And through the frame invisibly convey
Their subtle, quick vibrations as they play."

The dream images that "thrill the seat of sense" are a revival of registered sense impressions rendered peculiarly vivid because the natural channels between the outward world and the sensorium are closed. Hence, not being corrected by an incoming torrent of objective impressions, they engross the relatively meagre and imperfect sleep-consciousness, and seem realities. The same brain tract which is excited by the objective sense impression is occupied by the revived subjective image (Carpenter, Bain, Spencer). If we dream of things seen or felt or heard, it is the centres of those respective senses that are called into action, with such portions of the hemispherical (cortical) ganglia as have organic connections with them. It is remarked by Macfarlane that when many centres are active, dreams are consistent and coherent, while when few centres are working, they are unreal

and extravagant, *i. e.*, the difference in the quality of the dreams depends on the depth of the sleep.*

Dreams are principally of interest to the physician as being an indication of unsound sleep. The dreaming period seldom comes on in health till the time for waking approaches. Then the centres that are most automatic one by one recover their functional activity, those which represent the higher mental powers still remaining dormant. It is doubtless true that in sound sleep we never dream. If anything has been settled by the labors of physiologists during the past forty years, it is I think this, that the vascular and other conditions of perfect sleep forbid any mental manifestations. The condition of sound sleep is one of complete psychical inertia. A transcendental philosophy which teaches that the mind is always conscious and always active must have some higher foundation on which to rest than common sense and experience.

If the dreaming period comes on early, it is evidence of some irritation in some part of the body which is disturbing the rest of the brain. Thus, unseasonable dreaming is often symptomatic of indigestion, teething, a febrile condition, the influence of some toxic agent (tea, coffee, alcohol, etc.), and when dreams become pathological, it is a part of the physician's duty to discover the cause and remedy it.

* *Loc. cit.*, p. 31.

CHAPTER II.

INSOMNIA.

If the essential condition of sleep be torpor of the centres of conscious mentality, everything which excites these centres and keeps them functionally active will promote insomnia.

In discussing the causes of insomnia I shall adopt in part Professor Sée's classification, and shall consider these cases as: I. Psychical; and, II. Physical.

I. Under the head of Psychical Insomnia are included cases of sleeplessness due to mental emotion, to thought, worry—*i. e.*, internal causes not directly dependent on organic states or outward excitations. This kind of insomnia is that with which the author of "Night Thoughts" was (presumably) affected:

"From short, as usual, and disturbed repose,
I wake. How happy those that wake no more!
I wake emerging from a sea of dreams
Tumultuous, where my wrecked despondent thought
From wave to wave of fancied misery
At random drove, her helm of reason lost!"

Insomnia of the psychical order is illustrated in the student who is anxious about his examinations and cannot obtain rest till the result is known; in the candidate for political honors who cannot sleep till the election is over and his fate is decided; in the mother who will watch over her sick child night after

night, not closing her eyes till the crisis of the sickness is passed. Multitudes of such instances happen in daily experience. In order that natural sleep may occur, the mind must be tranquil; on this point it is useless to enlarge.

The pure hypnotics—chloral, paraldehyd, urethan, sulphonal—are generally quite efficacious in the insomnia due to emotional causes, the intensity of the insomnia being of course proportional to the intensity of the disturbing cause. Business cares and anxieties of all kinds, and, I may add, homesickness and disappointments, often produce a most obstinate wakefulness, which hardly yields to even large doses of chloral; sulphonal is almost without effect. In such cases the therapist is almost without resources.

“ Who shall minister to a mind diseased,
Pluck from the memory a rooted sorrow,
Rase out the written troubles of the brain,
And with some sweet oblivious antidote
Cleanse the stuffed bosom of that perilous stuff
Which weighs upon the heart?”

Under the head of psychical insomnia may also be classed sensorial disturbances of an unusual, intense, or persistent nature, whether of sight or of hearing, which prevent sleep. But these causes are so familiar to everybody that it suffices simply to mention them—illustrations are innumerable. Prof. Sic alludes to the effect often produced by prolonged

application of the eyes to reading and to the microscope, especially in the evening; this frequently provokes subjective excitations—"phosphenes"—whose constant reappearance prevents repose. It is useless to say that this kind of insomnia, being caused by physical agents, might properly come under the next division.

II. Under the head of PHYSICAL INSOMNIA, I shall, I, take up the group of physical causes, foremost among which are organic conditions productive of PAIN. If an irritation emanating from any organ or tissue may keep consciousness aroused and the cortex active when not painful, how much the more will it be likely to produce insomnia when raised to that degree of intensity known as pain? Pain implies a peculiar excitation of the sensory cortical centres and an awakened consciousness, and its very existence is inimical to sleep.

It is not necessary to dwell long on the causes of pain. It may be peripheral or visceral; may be due to inflammatory states of the nerve centres or their membranes, or to functional disturbances of nerves, constituting neuralgia; to conditions of anæmia or hyperæmia; to inflammation and suppuration; to ulcerative processes; to the pressure of tumors, exudations, etc.

The leading therapeutical indication is to remove the cause. This may be easy of accomplishment, as when the pain is from a carious tooth, or an abscess,

or it may be impossible to meet, as in many cases of locomotor ataxia with *douleurs fulgurantes*, in the pain of internal cancer, etc. The pain of migraine offers this peculiarity that it generally yields to the desire for sleep; other forms of neuralgia are apt to be worse at night. Often the causal indication must be kept in abeyance; the first thing to attend to is the *indicatio morbi*. A hypodermatic injection of morphine may be imperatively required, and it may be waste of time to attempt to relieve the pain by other remedies. In the insomnia due to cancer, to acute inflammation (pleurisy, pneumonia, peritonitis, pericarditis), abscess, the lightning pains of ataxia, to severe neuralgic attacks, it will not always be possible to obtain the relief requisite for sleep without recourse to opium or morphine. It is undeniable, however, that in antipyrin, phenacetin, acetanilid, and other of the new analgesics, we may often find good and comparatively harmless substitutes for opium or morphine. Thus there is a large amount of testimony to the benefits obtained from phenacetin, antipyrin, etc., in the pains of acute rheumatism, facial neuralgia, hemicrania, lumbago and pleurordynia, neuritis, zona, sciatica, and even in the *douleurs fulgurantes* of tabes.

The analgesic action of belladonna, cannabis Indica, hyoscyamus, is sometimes sought in insomnia due to pain; not much reliance, however, can be placed on any narcotic but opium.

There will always be one objection against opium

when used for hypnotic intent; it is not a good hypnotic, as it produces and long keeps up, in many persons, a cerebral excitation incompatible with sleep; hence where other analgesics, as antipyrin, acetanilid, prove to be sufficient to quell the pain, they should always have the preference.

2. *Insomnia due to overwork of the brain* is the insomnia of cerebral hyperæmia. Prolonged study, constant application to business, literary undertakings, speculative enterprises, etc., demanding vigilant thought and entailing much worry and anxiety are fruitful sources of insomnia. At the same time, exhaustive mental toil may be carried on with impunity provided the hours of sleep be not interfered with; provided also that suitable seasons of relaxation and diversion be snatched during the working hours. It is unremitting mental toil and worry that kills.

The theory that during mental work certain districts of the brain are flushed with blood is consonant with all the experiments and observations whereby we have acquired a knowledge of the physiology of the brain. It is also known that the blood supply to the brain is controlled by the vaso-motors, and it is a legitimate inference that in the insomnia from mental overwork the blood vessels of the cerebral cortex are overfilled from exhaustion of these nerves, or, what means the same thing, from exhaustion of the tonicity of the blood vessels.

Doubtless the age in which we live is peculiar in

the sense that multitudes are obliged to toil harder with their brains than any previous race. Never before, perhaps, in the history of mankind, did arduous strife and competition involving the higher nervous centres become so necessary. The present generation is the heir to all the acquisitions of the past, but these have been an ever accumulating burden, which is almost too great for the strong to bear, while the weak and exhausted must succumb beneath the load, though the latter be no more than just sufficient to equip its possessor for a fair chance in the struggle for existence.

It has been proved, however, that hard study can be borne with impunity provided that sufficient physical exercise be taken. This is a truth which the literary man and the student should ever have in mind. We have a good instance of this in the life of the late Frenchman, Littré, one of the most indefatigable literary workers of this age. His habit was to spend most of the day out of doors in physical recreation and exercise; and he only began his studies and his writing about seven o'clock in the evening when he would enter his library and pore over his books, absorbed in study, or bend over his writing desk, working without cessation, till three or four o'clock in the morning, when, yielding to fatigue, he would seek a few hours' refreshing sleep.

In a recent spirited publication, Mary Mana-

céine * has traced the causes, effects, and remedies of mental over-pressure in modern life. She lays great stress on the want of gymnastic training in schools, and the numerous unhealthy conditions of our civilization. The besetting infirmities of the age are "cerebral anaemia" and "nervous exhaustion." The causes are complex, but they all act similarly, "by producing irregularities in the vascular sphere," *i. e.*, by impairing the tonus of the cerebral blood-vessels. "When once the tone of the blood-vessels is lost, when their nutrition is disturbed and the circulation no longer responds to the exigencies of normal life, phenomena of dissolution begin to manifest themselves." Doubtless Mlle. Manacéine is right in regarding the stimulants (tea, coffee, alcohol, tobacco, etc.) in which the people of this age are prone to indulge as being large factors in producing a toneless condition of the cerebral vessels, but exhaustion by overwork, and especially by worry, are doubtless still more important factors.

With regard to the influence of physical overwork in producing insomnia, the explanation may not be so easy. A state of great physical fatigue is certainly favorable to sleep, but over-fatigue is attended with a painful aching of the muscles, which causes an excitation of the cerebrum. Germain Sée adds as a factor the accumulation of the products of denu-

* "Le Surmenage Mentale dans le Civilisation Moderne," Paris, 1890.

trition, which being in excess in the blood, act as toxic agents and excite the cerebrum.

With regard to the treatment of insomnia by mental overwork, the *indicatio causalis* first demands attention. The student must curtail his studies, his hours of work; must be content with a less honorable standing in his classes, must take more rest, more recreation, more exercise. These injunctions are especially imperative when the subject of insomnia is a growing youth; in fact, the appearance of insomnia, or dreamy, restless, unrefreshing sleep in children should generally be the signal for removing them for a time from school and prescribing suitable sports and recreations, a course of gymnastics, and other measures calculated to invigorate, subdue restlessness, and procure natural sleep.

Dr. Dukes, of Rugby, is of the opinion that boys under ten years of age require eleven hours' sleep, and those under thirteen need ten hours and a half set apart for this purpose.*

The same causal indications are applicable to the man of business, who, when once he finds himself unable to sleep of nights is on a downward scale, which will end in ruin unless he can pause and reform his habits. Even then he will realize the *facilis descensus Avernus*, while to retrace his steps—*hic labor, hoc opus est*. One of the most annoying forms of insomnia among business men is this: The patient goes

*Quoted by Macfarlane, *loc. cit.*

to bed and falls asleep to wake up in an hour or two with his mind full of the care and worry of the day, and then there is no more sleep all night long; or if sleep returns after several hours of wakefulness, it is a disturbed, dreamy sleep from which he awakes tired, jaded, and miserable. This kind of insomnia is called by Germain Sée true insomnia.

The following table is modified by Macfarlane from Friedlander, and contains his views as to the best division to be made of the twenty-four hours in the matter of rest, work, and sleep :

AGE.	HOURS FOR			
	Exercise.	Work.	Leisure.	Sleep.
7	7	3	4	10
8	6	4	4	10
9	5	5	4	10
10	5	6	4	9
11	5	6	4	9
12	5	6	4	9
13	4	7	4	9
14	4	8	3	9
15	4	8	3	9

Besides making the endeavor to pursue a course of life the reverse of that which he has been pursuing, the victim of insomnia from overwork will naturally for a time seek relief from some of the safer hypnotics, preëminently among which is sulphonal. From

my own experience, I would say that sulphonal is the king of hypnotics, conferring a sleep which is the most like natural sleep with the least after-discomfort. Nor does the continued use of this drug seem to be attended with real harm—at least with any such evils as follow the prolonged use of morphine or chloral. I know one business man who has been in the habit of taking ten grains of sulphonal every night for six months, nor has he yet found it necessary to increase the dose.

Chloral was formerly regarded as the ideal hypnotic, and in many cases it produces a sound refreshing sleep of several hours. The late Dr. J. R. Nichols, of Haverhill, told me in 1873 that chloral had been a boon to him—that one dose of ten grains taken at bed time would quite banish his insomnia for a whole week, the effect not wearing away for several nights.

In comparatively tractable cases of insomnia from overwork, a tablespoonful or two of old whisky at bed time will often work like a charm; sleep speedily ensues and lasts many hours; with many, a glass of bitter ale has a still better effect.

As natural sleep may be hypothetically regarded as brought about by certain toxic products of exercise, and as muscular exercise is known to be more productive of these hypnogenous substances than intellectual, so the medical adviser may very properly urge his patient to perform some severe muscular work

before going to bed—a long walk in the open air, dumb-bell exercise, etc. Many a victim of insomnia has found a remedy for his infirmity in garden work, joinery, wood-sawing, or even in such active sports as base-ball and lawn-tennis. Sleep is much more certain to follow muscle-tire than brain-tire.

As the leading indication is to induce that cerebral torpor which is the necessary antecedent of sleep, it is well to advise the insomniac patient to avoid all cerebral excitants in the evening. He should not indulge in tea, coffee, tobacco or spirits, with the exception, perhaps, of an occasional draught of old whisky on going to bed, as above stated; he should refrain from reading, writing, and other mental labor. Even novel reading (recommended by some as a diversion) is of questionable utility; listening to the reading of a dull book is a much more rational expedient. If one can succeed in breaking the train of thought by fixing the attention on any series of monotonous sounds (the singing of crickets, the roar of a distant waterfall, the whistling of the wind down the chimney, etc.), he will often before he is aware of it be caught in the toils of Somnus.

The sleep state being one in which the cerebral arterioles are contracted, with lessened circulation in the encephalon, the artificial production of this condition would seem to be favorable to sleep, and much account has been made of cold applications to the head made with the intent to exsanguinate the brain;

hot foot baths to determine blood from the head, and the general warm bath as a powerful means of derivation. Hammond states that he has seen the application of the cold douche to the heads of refractory prisoners bring on a deep sleep. I believe, however, that cold to the head, as a means of provoking sleep, oftener fails than succeeds, and I have even known it to aggravate the insomnia. Of more efficacy is bathing the trunk and limbs with cold water, followed by a brisk rubbing to induce a reactionary glow; standing naked on the cold floor a few minutes, then a hasty rub-down with a coarse towel or flesh-brush, often does good in the same way by derivation. The warm bath or wet-pack may be resorted to in desperate cases.

Macfarlane gives some excellent hints for the rational treatment of this kind of insomnia. To restore tone to the vaso-motor system, he advises a combination of *nux vomica* with hydrobromic acid.

R Acid hydrobromic..... 3 vi.
Tinct. nucis vom. 3 ii.
Aquamad. ʒ vi.

M. Sig.—A tablespoonful in a wineglassful of water twice a day, before meals.

To calm and strengthen the nervous centres, the patient should cultivate the habit of going to bed at a regular hour, and of rising with punctuality. The bed-room should be well ventilated, and the head raised upon a high pillow. The hours for eating and

drinking must be laid down with precision, the diet being adapted to the temperament and digestive powers, the last meal being taken some three hours before going to bed. The plethoric, whose vascular tension is high, do best without alcohol in any form, while the anæmic are often benefited by a moderate quantity taken with the food to promote digestion and a "night-cap" of brandy or whisky with warm water and sugar. On account of its stimulant and derivative action, turpentine in thirty-drop doses at bed-time is a powerful aid to sleep. It is easily taken in capsules. If it is found necessary to resort to hypnotics, the bromides are especially serviceable, the only contra-indication being great anæmia. Macfarlane prefers the bromide of lithium, as it contains a half more bromine than the potassium bromide. Its dose is from 10 to 20 grains. The bromides of sodium and potassium, which are in most frequent use in this country, are given in doses of one-half to one drachm. They are best prescribed in syrup and water, a full dose being taken a few hours before bed-time and another at bed-time. If these doses do not succeed in procuring sleep, they may be associated with ergot of rye and digitalis, both of which are stimulants of the vaso-motor centres. Macfarlane's favorite prescription is as follows:*

*Macfarlane, *Insomnia and its Therapeutics*, page 88.

R Bromidi lithii..... gr. xl.
 Ext. ergot liquld..... ʒi.
 Tinct. digitalis..... ℥xx.
 Aquæ chloroformi..... ʒ xv.

M. Sig.—Take one-half two hours before going to bed and the other half at bed-time.

3. To the third group belongs insomnia connected with a disordered state of one or more organs.

(a) *Morbid States of the Brain.*—These cause insomnia by interfering with cerebral nutrition. The changes taking place in the brain during cerebral hyperæmia are more of a katabolic than of an anabolic character, *i.e.*, are characterized by excessive waste rather than normal repair, hence are antagonistic to conditions which produce sleep. This hyperæmia may be active or passive. Active hyperæmia is due to overwork of brain (see preceding paragraph), to alcohol or other toxic agents, to arterial degeneration, to exposure to intense heat, the irritation of teething, to tubercles, syphilis, etc. The passive kind is generally due to organic diseases of the heart and lungs. Active cerebral hyperæmia is characterized by flushing of the face, throbbing of the temporals, congestion of the retina, suffusion of the conjunctiva, irritability, restlessness, giddiness, confusion of ideas, loss of memory, etc. In passive congestion, stupor is the most marked symptom.

In the active form, the indication is to lessen the quantity of blood in the brain; in the passive form, to increase the force of the circulation and lessen the

venous supply. The first indication is fulfilled by cold to the head, saline purgatives, leeches to the temples or outside the nose, mustard to the epigastrium, the constant galvanic current for two minutes—the positive pole being over the sympathetic, the negative on the nucha (Hammond). In this form of insomnia, it is necessary to prescribe the bromides, or, these failing, chloral. In the passive kind, diuretics, saline purgatives, and opiates rather than bromides are called for.

Alcohol, which is contra-indicated in active, is of great use in passive hyperæmia.

The cerebral hyperæmia with which we are most familiar either soon ends in recovery—the patient giving up his severe tasks or his excesses in eating and drinking, and living more rationally—or it is the *avant-coureur* of some severe and generally incurable brain affection. I have seen children suffer from flushed, hot head, vertigo, headache, irritability, peevishness (*i.e.*, the symptom—cortège of hyperæmia) for weeks before becoming the victims of hydrocephalus. I have seen it the precursor of apoplexy in the aged, being the first manifestation of atheromatous degeneration. It may be the first symptom of general paralysis of the insane (periencephalitis).

If simple hyperæmia be inimical to sleep, *à fortiori* inflammatory states of the cerebrum or its membranes must be so. The insomnia of acute meningitis, of periencephalitis, of cerebritis, is sufficiently familiar,

and even when the usual restlessness, agitation and delirium give place to the quiescence of coma, it is the repose of paralysis and death, rather than refreshing sleep, that is witnessed.

In tuberculous meningitis, among the first symptoms of the hyperæmia which precedes the developed disease, is a restless, dreamy sleep, which next gives place to complete insomnia.

In the treatment of sleeplessness due to inflammatory conditions of the cerebrum, the general principles laid down under cerebral hyperæmia are to be carried out. Full doses of chloral with bromides sometimes give brief seasons of quiet, if not productive of real sleep. I have found a combination of sulphonal with antipyrin more or less efficacious in the restlessness and delirium of meningitis.

R Sulphonal.
Antipyrin. 33 gr. x.

M. Sig.—One powder. To be repeated every hour till sleep or quiet is produced.

This combination is especially indicated in hyperpyrexia.

Cerebral tumors are a cause of sleeplessness, both from the inflammation which they excite and the pain which is a constant attendant.

Anæmia of the brain, whether produced by excessive loss of blood, profuse discharges from the intestines, from chronic abscesses, etc., by insufficient food, by exhausting diseases or other causes, gives

rise to sleeplessness or imperfect, dreamy sleep. The explanation of this insomnia is that in the anæmic there is not only an exsanguinous state of the brain, but a vice of nutrition resulting from insufficiency of arterial blood. Germain Sée adds another cause which applies to certain cases; the local oligæmias are generally due to emboli or obliterations of arterioles, and the failure of nutrition goes on rapidly to ramollissement, the initial symptoms of which are always those of excitation.

The following case illustrates the general treatment of sleeplessness due to anæmia:

Mrs. M. B.; aged fifty; mother of eight children; consulted me in May, 1883, for a uterine trouble whose principal manifestation was excessive hæmorrhages. I found her weak and anæmic, obliged to keep her bed the most of the time. The heart's action was feeble; there was a systolic (anæmic) bruit; exertion, excitement, even ordinary food, would often bring on palpitations; walking or an attempt to work caused breathlessness. The face was frequently flushed (paresis of the vaso-motors); there were ringing noises in the ears, flashes of light before the eyes, and other perversions of the special senses; it required but little exercise of the eyes to tire them—reading, sewing, etc., after a few minutes became painful. There was an almost constant headache, with mental enfeeblement, and inability to apply the mind more than a few minutes to any subject. The insomnia was marked.

I found a uterine polypus to be the cause of the profuse hæmorrhages; this I removed by an ecraseur, thus arresting the loss of blood, but Mrs. B. suffered for months from the anæmic symptoms just mentioned. The distressing insom-

nia would only yield to opiates with draughts of whisky or bitter ale. A hypodermic of morphine always gave most relief, but this was seldom resorted to through fear of forming the morphine habit. A mixture of equal parts of red lavender and ammoniated tincture of valerian, dose a teaspoonful in water, often had a marked soothing effect. Chloral was avoided; when taken formerly while Mrs. B. was under the care of another physician it had always produced excitement rather than quiet. A cordial frequently prescribed consisted of compound tincture of lavender, one drachm; tincture of valerian, one drachm; deodorized laudanum, twenty drops; this was taken at bedtime. After a few weeks had gone by, I omitted opiates altogether, giving only the whisky or ale at night; this also was eventually abandoned, a little beef tea or fluid beef being given instead. A course of physical exercise had been commenced—walks, rides in the open air, parlor gymnastics which powerfully promoted natural sleep. Throughout the treatment, nutrients were administered day and night in as large quantities as could be assimilated; thus always between meals a cup of beef tea or of warm milk with bovine was given; an egg-nog was taken the first thing in the morning and a cup of milk with Mellin's food and a spoonful of bovine at midnight. Eventually the recovery was as complete as could be desired.

I have on record numerous cases of a similar kind, where the distressing insomnia brought on by long-continued discharges has yielded to suppression of the cause and the plentiful administration of stimulants and nutrients.

The cerebral anæmia accompanying aortic-valvular disease finds expression in an obstinate insomnia, in frequent attacks of vertigo, in intellectual disturbances, and in a profound irritability which has been

described under the name of irritable weakness. A similar line of treatment to that above indicated is needed, but the main reliance must be in opium or hypodermic morphine, in alcoholic stimulants, and in nitro-glycerin. It is hard to draw the line between anæmia and passive congestion, but it must be remembered that in aortic disease the brain is insufficiently supplied with arterial blood, and hence is anæmic. It matters not if the cerebral substance is charged with venous blood, unless the subject is supplied with plenty of arterial blood and there is a free circulation, the condition of the cortical cells is none the less one of anæmia.

(b) *Degeneration of the cerebral arteries* is a cause of hæmorrhage or softening, and one of its common symptoms is troublesome dreaming or insomnia, though some cases are characterized by morbid somnolence. Dreaming in advanced life is generally regarded as suggestive of pending apoplexy (Macfarlane). In the treatment of this kind of insomnia, the general principles applicable to cerebral anæmia are to be observed. Macfarlane speaks well of a mixture of henbane and camphor, and of sumbul and hops,* and professes to have obtained good results

* His formulæ are as follows:

R Spts. chloroform..... ʒ ss.
Tinct. sumbul..... ʒ ss.
Tinct. lupuli..... ʒ l.

M. Sig.—Two teaspoonfuls in water every hour till sleep is procured.

℞ Tinct. digitalis.....	℥xx.
Tinct. sumbul.....	3 j.
Tinct. lupuli.....	℥ij.
Aquam ad.....	℥ij.

M. Sig.—Take one-half at bedtime in water, and repeat in two hours if required.

from sponging the nape of the neck with hot water and from the application of mustard plasters for a few minutes over the epigastric region or the upper part of the spine.

(c) Hysteria, hypochondriasis, mania, melancholia, are affections due to disturbances of nutrition of the cerebral cortex. The limits of this treatise will not allow a separate consideration of each of these affections, which belong to the category of neuroses rather than of organic diseases. Nor can we here discuss the general subject of insanity in its relation to insomnia.

The sleep in hysteria may not be materially lessened in amount, but it is often unrefreshing. The hysterical subject wakes in the morning with a sense of physical fatigue or of mental depression or irritability. Dr. Mary Putnam Jacobi gives us an ingenious explanation which is worth reproducing.

In the nervous system, and especially the brain, the waste products do not pass directly into the capillaries, but into the lymphatic sheaths surrounding the arteries. The circulation of the lymph current, and its passage from the perivascular to the sub-arachnoid spaces, is regulated by the pulsations of the brain or its variations in volume, by which the lymph spaces are rhythmically compressed. The brain

pulsation is composed of three factors: The arterial pulse wave, the respiratory wave, and the vascular wave. The respiratory wave results from the aspiration of venous blood from the brain during respiration and the obstruction to its flow during expiration. The vascular wave advances like a peristaltic movement, and consists in rhythmic contractions and dilatations of the arterioles, apart from the cardiac pulse and dependent on intermittent vaso-motor influences. This vascular wave is said by Buckhardt to be much more regular during sleep than in the waking period and constitutes the principal motor mechanism for removing waste products through the lymphatic channels. If it be true that this vascular wave is of more importance in the lymph circulation in the brain than either the pulse or respiratory wave, it is clear that any disorder of the vaso-motor centres which govern it may greatly disturb the removal of waste products by interfering with the normal development of such a wave. If, for example, the normal intermittence of vaso-motor impulses becomes exchanged for a permanent tonus, the diastolic portion of the wave would disappear, and with it the swelling of the hemispheres by which the ventricles are compressed. There would remain the variations in volume due to the cardiac systole and diastole, but in sleep these are reduced to a minimum. Hence in any person subjected to abnormal vaso-motor irritations must exist an imperfect removal of waste products from the brain during sleep and therefore imperfect refreshment by the great restorer.*

The above considerations are not to be regarded in the light of mere speculation, but are legitimate deductions from accurate*experimental observations by Buckhardt and Meynert. The same causes of imperfect sleep are doubtless more or less operative in

*Hysteria and Brain Tumor, New York, 1888.
4 and

neurasthenia, and in all forms of functional brain disease.

(d) It is but natural that such painful affections as spinal meningitis and myelitis, and locomotor ataxia in its acute stages and painful crises should cause sleeplessness, only allayed by benumbing the seat of pain with anodyne narcotics, and only removed by successfully combating the disease.

Antipyrin, or acetanilid, in ten to fifteen grain doses, frequently repeated till its sedative action is experienced, often has a charming effect in relieving pain, irritation, fever, and thus promoting sleep. No medicine probably has given so much relief in these forms of spinal disease as antipyrin, but the doses must be large and continuous.

In one case of locomotor ataxia with lightning pains that came under my observation, acetanilid in doses of ten grains an hour never failed to subdue the pains in the course of a few hours, though the patient often became restive under the pain and demanded a hypodermic of morphine.

INSOMNIA OF RESPIRATORY ORIGIN.

Under this head we propose to consider chiefly dyspnoea and cough in their relation to insomnia. In acute diseases of the respiratory organs, pain and fever are influential along with other factors in the production of an insomnia which naturally yields when the acuteness of the disease subsides. In pleurisy and

even in pneumonia the pain may be severe enough to require an opiate, and even a hypodermic of morphine; with regard to pneumonia, I think that we should be chary in the use of opiates, no matter how severe the cough or the pain may be. This I say from experience, without formulating any theory in explanation. I know that the pain of this disease often yields to a sinapism or hot poultice, to a full dose of quinine with extract of aconite, and to repeated full doses of veratrum viride. My friend, Dr. B. W. Bartlett, of Rowley, has great faith in the application of a dozen leeches to the chest in the onset of pneumonia, with hot water fomentations prolonged for hours afterwards; the pains are alleviated and rest promoted without the assistance of any anodyne.

The dyspnœa of respiratory disease (apart from cardiac complications) is either spasmodic or obstructive. Spasmodic dyspnœa is exemplified in false croup, in bronchial asthma, and in true asthma. In all the bronchial affections of children a neurosal element can be clearly traced; this is especially noticeable in the paroxysmal cough and dyspnœa of whooping-cough.

Respiratory dyspnœa when not due to spasm may be the result of obstruction: *a*, by exudation within the pulmonary parenchyma as in pneumonia; *b*, by exudation within the pleural cavity (pleurisy); *c*, by swelling of the bronchi and profuse bronchial secretion (acute bronchitis, especially capillary bronchitis).

The treatment of insomnia from any of the above conditions resolves itself into the endeavor, as far as possible, to alleviate or remove the cause. Bronchitis should be treated in the earlier stages by medicines which allay febrile excitement, vaso-constriction and spasm, in short, by remedies which diminish the peripheral resistances. Among these, I think, antimonials,* ipecacuanha, veratrum viride, and lobelia inflata still hold the first place.

- ℞ Antimon. et. pot. tart. gr. j.
 Nitrate of potassium 3 j.
 Mucilage vel. aquæ ʒ vj.
 M. Sig. A tablespoonful every two hours.
- ℞ Vin. ipecac. 3 ij.
 Mucilage ʒ vj.
 M. Sig. A tablespoonful every two hours.
- ℞ Fluid ext. verat virid. 3 ss.
 Aquæ ʒ ij.
 M. Sig. A teaspoonful every hour or two.

When the bronchial secretion is well established, the antimonial and other depressant may be omitted and carbonate of ammonia substituted in five grain doses. A small dose of chloral may be admissible at bed time; when the secretion is very profuse an emetic of sulphate of zinc or turpeth mineral may be given as Macfarlane recommends. After the tubes

*The combination of tartar emetic and morphine, $\frac{1}{4}$ grain every hour till the oppressive cough ceases, is one to which I have often had occasion to resort.

are emptied, a dose of urethan (gr. xxx) of paraldehyde (3 j.), or even a Dover's powder (gr. x) may be administered.

The general principles of treatment of neurosal dyspnoea are the same, whatever name may be applicable to the particular manifestation. Antispasmodics and anæsthetics are always indicated; in attacks of spasmodic asthma and laryngismus stridulus, a few drops of the anæsthetic mixture A. C. E., inhaled from a sponge or towel, always give relief.

℞ Alcohol 1 part.
Chloroform..... 2 parts.
Ether..... 3 parts.

Mix.

Nitrate of amyl, gtt. iii, inhaled from the palm of the hand frequently gives instant relief; chloral hydrate with potassium bromide in full doses is slower in its action, but more permanently reduces inordinate reflex excitability. With some patients hypodermic morphia is a necessity. In laryngismus stridulus or spurious croup an emetic is generally sufficient speedily to relax the spasmodically tightened air-tubes. Of all emetics the turpeth mineral is the one which in my practice has yielded the most satisfactory results. Parke, Davis & Co. make tablets of this salt containing two grains, which are very convenient.

A more frequent cause of insomnia is cough.

I have not space to review the various pathological conditions productive of cough and supplement

such review by therapeutical hints. The most that I can do is to touch upon a few points of practical importance in connection with the relation of insomnia to cough.

In the early stages of consumption, the patient may be tormented with a teasing cough which is for the most part dry. Every physician is familiar with such cases. The physical signs are obscure; at the most there is a slight dulness under one or both clavicles, but there is a little febrile movement every day with failure of appetite and strength. This cough indicates an irritation of the respiratory organs by bacilli and tubercles, and is not alleviated by the ordinary expectorants. Here calmatives and sedatives with counter irritation do little or no good. A pill of codeia, one grain, at bedtime will sometimes effectively allay irritation and produce sleep. Chloral, bromide of potassium, cannabis Indica, hyoscyamus and belladonna may all be tried, with doubtless some alleviation at first; while nothing will so promptly relieve and so thoroughly as morphine. The latter medicament may be combined with dilute hydrocyanic acid, chloroform, and tolu, as follows:

R Chloroform..... gtt. xvj.
Morph. sulph..... gr. ij.
Acid hydrocyanic, dilute..... gtt. xxj.
Syrup tolu..... ℥ ij.

M. Sig.—A teaspoonful at bedtime and at midnight when the cough is troublesome.

A spray of liquid albolene and menthol used by a hand atomizer will sometimes allay the tickling in the upper air passages which seems to be the point of departure of the cough.

R Liquid vaseline..... ʒj.
Menthol..... ʒss.

M. For the spray-producer,

Such patients are often benefited by full doses of "Rock and Rye" on going to bed.

I have seen good results from small blisters applied to the upper part of the chest, or from painting the upper thorax with tincture of iodine till the skin begins to peel.

Of the various cough troches, there is one made by Parke, Davis & Co. and other of the pharmacists, containing a little cubebs with extract of licorice, which has given satisfaction in my practice. I have seen somewhere the advice to paint the throat with liquor cocaine; this expedient I have never tried, but I should think that it might produce some temporary alleviation.

In the later stages of phthisis when expectoration is profuse, it is not always safe to arrest the cough by narcotics given at bed-time; there is so much secretion from the vomica and inflamed mucous membrane that frequent fits of coughing are necessary to remove muco-pus and prevent asphyxia. In such cases an emetic of sulphate of zinc sometimes

has a salutary effect in clearing the bronchi and permitting a few hours' quiet sleep. I have found belladonna serviceable in restraining secretion; this may be prescribed in the form of a pill of atropine, $\frac{1}{16}$ th grain, night and morning. Senega, turpentine, tar, sulphur, and carbonate of ammonia have a reputation when there is copious expectoration, and the spray of ipecacuanha wine, as recommended by Murrel, may be tried to advantage.

The syrup of tar, with carbonate of ammonia, and the Compound Pine Expectorant of P., D. & Co., are preparations which have become popular.

The catarrh is a product of bronchial congestion provoked and kept up by the presence of tubercles, and cannot be much modified while active tuberculization exists.

In the teasing, paroxysmal cough of pertussis, full doses of antipyrin or acetanilid have proved of great efficacy.

R Acetanilid..... 3 ss.

Divide in chart, No. vi.

Sig. Give one powder every four hours night and day, and keep up the treatment for a week or even a fortnight.

For a child of 10 years, the five-grain tablets are very convenient. The one-grain tablets (one every 4 hours) may be prescribed for infants.

Antipyrin, phenacetin, or exalgin in equivalent doses may be given instead of acetanilid. I have given infants two years old grain doses of antipyrin

every two hours in whooping-cough, and seen the paroxysms markedly diminish in frequency and violence under this treatment. The quantity of either antipyrin or acetanilid may be increased, if necessary, till a decided constitutional impression is produced.

I used to give bromide of potassium in whooping-cough, with or without chloral, and have seen marked mitigation of the paroxysms thereby produced.

R Pot. bromid. 3 ij.
Hyd. chloral. 3 ss.
Syr. tolu. 3 ilj.

M. Sig. A teaspoonful every hour till sleep is produced. For a child 5 years old.

THE INSOMNIA OF HEART DISEASE AND ITS TREATMENT.

In aortic disease (constriction, insufficiency, aortitis, aneurism) the arterial outflow is embarrassed, and unless the compensatory hypertrophy be sufficient through the extra power thereby given to the heart-muscle to ensure filling of the arteries, the whole organism suffers in its nutrition and function, and no department more than the cerebrum. Hence, the insomnia of aortic disease is essentially the insomnia of anæmia.

But there is generally more than this. The blood-depurating organs participate in the general disturbance of nutrition, and imperfectly eliminate waste elements, and to the poverty of arterial blood

in the system is added a more or less toxic condition of the blood.

Now that we are better acquainted with the conditions productive of aortic affections, we know that the latter are very often the expression of that widespread disease of the arteries, arterio-sclerosis; the victim of heart disease has interstitial nephritis, and, sooner or later, becomes anæmic.

A peculiar state of mental irritability generally accompanies aortic disease, and may even give rise to a form of insanity.

Among the symptoms of aortic disease are paroxysmal crises of dyspnœa (cardiac asthma), especially frequent at night, and attacks of precordial pain, which arrest the patient in his occupation; if he is walking, compel him to stop and lean against some support.

The pain in the earlier stages of aortic disease is characterized by momentary pangs, and is the result of exertion; in extensive atheromatous disease of the aorta involving the coronary arteries, it is of a much more intense, prolonged, and agonizing kind, and is true angina pectoris.

In the treatment of the insomnia of aortic disease, the mechanism by which this insomnia is brought about must be kept in mind. A leading indication is to promote the arterial blood supply of the brain, and thus improve its languishing nutrition. The pure hypnotics, chloral, paraldehyd, sulphonal, are rarely

useful, while there is one remedy which is of sovereign efficacy, which energizes the circulation and relieves dyspnoea and pain. "Opium," says Gabler, "determines a particular excitation, gives fullness to the pulse, raises the temperature, augments the injection of the teguments and promotes diaphoresis. The countenance brightens, the eyes become brilliant and moist, the pupils contracted, the skin covered with perspiration, then quiet sleep ensues."

The morphine may be associated with atropine and administered hypodermically, and for this purpose the compressed tablets (sulph. morph., $\frac{1}{4}$ grain; sulph. atropia, $\frac{1}{100}$ grain) are very useful. It may be necessary to resort to these injections very often—every day, with gradually increasing dose—and there will be the risk of rendering the patient a morphomaniac, but it is a choice between two evils in an incurable disease steadily becoming worse.

As to the question of the applicability of digitalis in aortic disease, there is considerable difference of opinion. A weak, struggling heart always seems to demand this potent remedy, but practically it has not been found, at least in the earlier stages of aortic disease, to be so beneficial as nitro-glycerin and the vaso-dilators. The reason is probably this, as stated by Huchard: that the "cardio-aortic" patient is not only suffering from anæmia, but from a poisoned condition of the blood—the dyspnoea and the precordial anguish are often toxic, and are the expression of

spasmodic constriction of the arterioles, a condition which is favored by digitalis, whose tonic action extends to the whole arterial system. Under the influence of this drug, the arterioles are tightened rather than relaxed, while, on the contrary, nitrite of amyl and nitrite of soda, and especially nitro-glycerin systematically and perseveringly administered, relax the arterial system, thus inviting rather than opposing the sanguineous outflow, and lightening the work of the heart. To these remedies may be added an exclusive diet of milk, which by its nutrient properties, its easy digestibility, its absence of toxic extracts, and its marked diuretic action wonderfully promotes the comfort and well-being of these "cardio-arterial" subjects.

The insomnia of mitral disease, as well as of a number of other forms of heart disease, is closely associated with the dyspnœa that attends those affections, and this is a convenient place for a few more general considerations on cardiac dyspnœa and its treatment.

CARDIAC DYSPNŒA.

When we consider the frequent coincidence of cardiac lesions with dyspnœa, we cannot regard it as surprising that in the infancy of pathological anatomy Rostan, noticing in a large number of aged patients at the Saltpêtrière, recorded as asthmatic, definite lesions of the heart and aorta, should have concluded that asthma, as an idiopathic malady, does not exist,

being always symptomatic of diseases of the circulatory organs.

When we inquire into the conditions of cardiac dyspnœa, we find them to be: Mitral stenosis and insufficiency; myocarditis and fatty degeneration of the heart-muscle; dilatation of the ventricles and aorta, from whatever cause; and uncompensated lesions of the valves of the aorta and pulmonary artery.

In the case of most of the above causes, the *modus agendi* is very simple; the dyspnœa is of mechanical origin, being the result of pulmonary stasis; the heart is unable to clear the capillaries in the sphere of the lesser circulation.

Most persons affected with mitral disease are short-breathed; when at rest they have little or no dyspnœa, but they immediately suffer for want of breath when they attempt any considerable exertion, as going up a flight of stairs or ascending a hill. In the earliest stages of mitral insufficiency the dyspnœa may be hardly noticed, except when the heart is severely taxed, as in the effort of running; in advanced stages the difficult breathing becomes permanent on account of the constant pulmonary engorgement. There is nothing asthmatic about this, for the essential characteristic of asthma is the intermittent and paroxysmal character of the dyspnœa.

The difficult breathing attending aortic-regurgitant disease, aortitis, dilatation of the heart cavities and aorta, fatty degeneration, etc., is generally parox-

ysmal in its nature, and the attacks come on in the night time rather than in the day. The explanation given by Professor Sée was formerly regarded as satisfactory: "The blood-stasis in the lungs, which is the first cause of the oppression, manifests itself generally in the night time, because it is favored by declivity, that is, by the dorsal decubitus; to this first cause are added others which contribute much toward provoking the explosion of those attacks of respiratory distress which often present a formidable intensity. These purely mechanical causes are: Distension of the stomach, and the forcing upward of the diaphragm, which notably diminish the respiratory area, already insufficient for hæmatosis. Add, as accessory causes, bronchial catarrh and frequent concomitant emphysema, and you have the entire ætiology of paroxysmal dyspnœa linked to affections of the heart."*

The dyspnœa due to dilatation of the heart, according to Professor Sée, is not always continuous, though there are paroxysms and exacerbations, and that due to fatty degeneration is *uni generis*, "presenting sometimes real paroxysms of distress and suffocation at the same time that careful examination of the lungs does not reveal any morbid signs; there is not the least acceleration of the breathing, or any apparent impediment to respiration."

Irritation of the cardiac and respiratory plexuses

* *Maladies du Cœur*, etc., 1883, p. 30.

of nerves, as Peter, Trousseau, etc., teach, has been believed to have some share in the respiratory distress; and the magical relief conferred by a hypodermic injection of morphine or other calmative before even the pulmonary congestion or cedema is mitigated, has been cited in confirmation of this doctrine.

Henri Huchard has of late written much and lucidly on the paroxysmal dyspnoea of aortic regurgitation and aortitis. The dyspnoea of aortitis is, like that of mitral disease, at the first a dyspnoea of effort, coming on during rapid walking, lifting, etc.; it is paroxysmal and often intense, rarely spontaneous. Later on in the disease the attacks come on in the night time, often reproducing themselves with great regularity, so that the patient is obliged to pass the night in his arm-chair. Huchard regards this "aortic pseudo-asthma" as due to arterial hypertension which "augments by the recumbent posture and under the influence of sleep, as also by walking, and under the influence of movement." The cause of the dyspnoea is "mechanical," as Professor Sée taught, but not in the same sense as he taught, for in Huchard's view we have to do with "peripheral resistances," and "spasm" of the blood-vessels. If, says Huchard, distension of the stomach has anything to do with the paroxysmal dyspnoea, abstinence from the evening meal or a very frugal repast ought to keep the patient free from his nocturnal attack; this is, however, sure to come, whether he eat little or much.

This dyspnoea, Huchard affirms, is also of toxic origin. Experiments like the following seem to demonstrate this: He injects under the skin of a guinea-pig normal urine; death ensues in several days. He injects the same quantity of urine from a woman affected with arterio-sclerosis of the heart and aorta, and the guinea-pig scarcely suffers any detriment. This proves, he says, that the blood of his patient was poisoned by the products of disassimilation which the kidneys, already impermeable by the fact of the aortitis and a commencing arterio-sclerosis, could but incompletely eliminate. These views, he urges, are not simply theoretical, they are confirmed by practice. In fact, blood-letting, purgatives, nitrite of amyl, nitro-glycerin, etc., which depress arterial tension, contribute in large measure to diminish the intensity of the attacks. But nothing works so well as an exclusive milk diet, which acts marvelously in combating these attacks of aortic dyspnoea, often keeping them completely in abeyance. Now milk diet, according to Huchard, acts in two ways and meets two indications: First, by the abundant diuresis which it provokes, the milk diminishes the arterial tension and promptly eliminates the toxic principles contained in the blood; then it acts by virtue of its very harmlessness and because it does not contribute to the blood in circulation, like other aliments, and meat in particular, materials which, not being completely eliminated, become rapidly toxic to the economy.

INSOMNIA OF GASTRO-INTESTINAL ORIGIN.

Writers have dwelt much on the cerebral hyperæmia attending disordered states of the stomach. That indigestion causes insomnia by exciting the cerebrum is a matter of common experience. With many persons, even, the active exercise of digestion, if this be at all difficult, is incompatible with sound sleep. Such individuals refrain from lunching or partaking of a hearty meal before going to bed. Certain valetudinarians cannot drink a glass of milk or eat a biscuit late in the evening without atoning for the indiscretion by hours of sleeplessness.

Such inhibition of the cerebrum by the stomach is of frequent experience in the nursery. The first thing the physician thinks of when consulted with reference to insomnia in a young child is the probability of indigestion as the main factor in the case. What is the quality of the food, what about the quantity, and what is the condition of the digestive organs? Attention to these points, in the absence of objective signs of importance, as fever, will generally put one on the track of the cause and suggest the remedy.

The indigestion may be functional or organic, and all pathological conditions of the stomach are likely to be accompanied by insomnia. Structural diseases, as gastritis, ulcer, gastrectasis, cancer, cause sleeplessness, both by the pain and discomfort, and the consequences of indigestion which attend them.

One of the most frequent symptoms of indigestion is flatulence. The stomach, by failure of the normal peptonization process, is inflated and oppressed by the gases of decomposition; the distended stomach presses on the thoracic organs, embarrassing the heart and causing troublesome palpitations. Toxic products are often formed by the mal-elaboration of peptones; these irritate the nervous centres and render the cerebrum hyperæmic.

But there is another aspect of the question. In persons with healthy stomachs and normal arterial tone, the digestive process is not prejudicial to sleep. Somnolence, in fact, often attends digestion, especially after a hearty meal. This has been attributed to the flushing of the stomach—at the expense of the cerebrum—which is a necessary condition of its function. Digestion normally occurs without attracting the consciousness, and there is no reason why on proper occasions sleep should not follow a hearty meal in men as well as in carnivorous animals. It is not true that during sleep the digestive functions are practically suspended, as some authorities have said: "During sleep the medullary centres relax their activity, digestive fluids are not secreted, and the movements of the gastro-intestinal canal almost, if not entirely, cease."* It is surprising to meet with an error of this kind in a writer ordinarily so accurate as

* *Insomnia and its Therapeutics*, p. 192.

Macfarlane. The stomach and intestines continue their function during sleep, though with lessened activity; the secretions are not suspended, the unstripped muscular fibre continues a constant though diminished action; the spinal cord even seems preternaturally active, the inhibiting restraint of the cerebrum being withdrawn. In reality, in sleep all the essential functions continue to be exercised. Those most indispensable to life, circulation, respiration, digestion, etc., are performed as during the waking period, though more sluggishly. Thus, the heart beats more slowly during sleep. "*Pulsus in somno parvi, languidi, rari*," says Galen. With the retardation of the circulation, there is diminished activity of the secreting glands (gastric, intestinal, pancreatic, etc.), but in healthy persons these organs are adequate to the work imposed upon them, as is proved by the fact that multitudes can eat a full meal* on going to bed, sleep soundly, and be ready for another meal on awaking. Nor can it be said that the peristalsis of the gastrointestinal canal ceases during sleep, any more than the contraction of other unstripped muscles (the arterioles, for instance), which are not under the will.

Germain Sée, who refers most cases of digestive insomnia to difficulties attending the secondary or intestinal digestion (and here he is seconded by Macfarlane) thus defines this kind of insomnia: "Intestinal digestion generally begins three hours after a meal and ends in seven or eight hours. The patient, we

will suppose, sups at 6 o'clock P.M. At 10 o'clock he goes to bed, but cannot sleep till long after midnight. This is the time when the pancreatic-intestinal digestion is going on; when this is finished, the patient goes to sleep.

"To prove that I am right as to the cause of the insomnia, let the patient eat a light supper at the usual time, or let him sup at 4 o'clock in the afternoon, and he will find that he will go to sleep at the proper time."*

In the treatment of insomnia from indigestion, the quantity and quality of the food must be taken into account, the conditions of the stomach, intestines, and the auxiliary organs.

(1) Errors are most frequently committed as to quantity. The digestive organs may be competent to dispose of a certain bulk without pain or difficulty, while an excess causes embarrassment to the stomach; decomposition and flatulence set in under unmolested microbic rule; putrid and more or less toxic gases and ptomaines are generated, and a "bilious" condition supervenes, such as every one has experienced at times. It is doubtless true that while multitudes are underfed, more persons are injured by excessive eating than by a spare diet. Insomnia naturally comes in as one of the consequences of over-eating and over-drinking, for a burdened stomach will not let the brain rest.

* Des Dyspepsies, etc. Second edition. Paris, 1883.

The proper remedy for sleeplessness arising from this cause is apparent; it is to curtail the daily rations to the physiological standard. The necessity of eating slowly and deliberately with thorough mastication of the food, is apparent; those that "bolt" their food are sure to eat to excess.

(2) Food of poor or insufficient quality produces anæmia and starvation of vital organs, including the cerebrum, and hence engenders insomnia. Physicians cannot too much insist on the necessity of a full diet, that is, of an adequate admixture in the daily fare of albuminoids, fats, and carbo-hydrates. Food of indigestible quality produces essentially the same evils as excessive alimentation. Under this head may be included food improperly or insufficiently cooked (good cookery under our civilization has become indispensable to healthy digestion), and foods that most persons of sedentary habits find hard to digest, as unripe fruit, pastries, hot bread, fried pork, confectionery. Of course, butcher's meats should be selected that are tender and juicy, and in the light of recent discoveries (Gautier, Selmi, etc.), it is doubtful if meat or game that has become high (*faisandé*) is fit for food.

Foods of themselves sufficiently digestible may become indigestible if too many kinds are eaten at a meal. But this brings us again to the evils of excessive eating.

It need not be repeated that he who would sleep

well must avoid those articles of diet which have been found to be indigestible, or should indulge in them sparingly. Much depends, of course, on the muscular work done. Horace speaks of the *dura ilia messorum*. The hay-makers on the salt marshes need food hard of digestion, that is, food that is *slowly* digested, yielding up force for many hours; food that in common parlance "stays by," such as baked beans and pork, boiled beef and cabbage, and mince pie. Such persons sleep well, despite their hearty fare; it is especially the "brain-workers," the men of sedentary habits that are upset by a rich diet.

(3) A healthy digestion presupposes a healthy state of the stomach, intestines, and accessory organs, and any derangement of these viscera must be corrected by suitable medicinal and dietetic means before normal sleep can be enjoyed.

To enter on a consideration of all these derangements would take more space than we have at our command. The hygienic treatment of indigestion includes dieting, exercise, recreation, cold bathing etc. The cold shower-bath in the morning is sometimes a powerful aid to digestion. Exercise promotes a more vigorous circulation and favors peristalsis and chymification; equally necessary are change of scene, diversions, and the cultivation of a contented, cheerful frame of mind.

Among the medicinal means are:

(1) Such as favor gastric digestion, namely, alka-

lies before meals, and acids with pepsin, after. Clinical experience has proved pepsin to be of some value. Small doses of strychnine are useful.

(2) For acid dyspepsia full doses of bicarbonate of soda are naturally indicated. Professor Sée advises dyspeptics with excess of acid secretion to take a drachm of bicarbonate of soda in hot water on going to bed. It is certain that in certain morbid states of the stomach and intestines, whether due to "*hyperchlorhydria*" or to excess of mucus, the beneficial sedative effects of alkalies are pronounced.

(3) Constipation is another recognized cause of insomnia, whether by the reflex irritation of retained excreta, or by the flatulence which frequently attends a loaded colon. Here the remedy is obvious; such laxatives as rhubarb, Glauber salts, cascara, enemata of hot water, etc. Persons who sleep poorly from this cause often find a hot water enema on going to bed a sovereign remedy.

When that old bugbear, a torpid liver, is at fault (if this can be determined), of course a blue pill, a dose of enonymin or podophyllin would seem to be indicated.

There is an acidity of the stomach which depends on abnormal acid ferments, the products of decomposition of starches or sugars in the food. In these cases, washing out the stomach by means of emetics and copious draughts of warm water every night for three or four nights, as Macfarlane recommends,

often proves very efficacious. The same writer advises ferro-alumen in three-grain doses for pyrosis along with three drops of dilute hydrocyanic acid, and turpentine in ten-drop doses for flatulence, as most effective remedies.

Gastralgia and gastrodynia demand anodynes and anti-spasmodics. In the experience of many authorities, a pill of opium, or an equivalent of the deodorized tincture is more efficient in gastralgia than morphine hypodermically or by mouth.

In the treatment of gastric neurasthenia, the following therapeutic regulations may be carried out:

1. The patient may take with each meal 5 grains each of salicylate of bismuth, magnesia, and bicarbonate of sodium.
2. He may take, on going to bed, a dessert-spoonful of compound licorice powder.
3. Every day he may have a cold jet-douche of 15 seconds' duration applied along the vertebral column; energetic dry friction with a flesh-brush after the douche.
4. Walks in the open air, muscular exercises (fencing, opposition gymnastics, etc.) are beneficial.
5. There should be only two meals a day, the one at 10 A.M. and the other at 7 P.M. The diet should consist chiefly of eggs, cereals, green vegetables and fruits; the eggs to be nearly raw, the starchy foods and vegetables to be thoroughly cooked, the fruits to be stewed. Drinks to be water

or a light white wine with ordinary water; no gaseous waters, no pure wine, no whiskey or other distilled liquors. Such patients often do best on a *dry diet*.*

Intestinal indigestion is to be treated mainly by dieting. The liquor pancreaticus has been recommended by some writers; it is doubtful if pancreatin exercises any action outside of the stomach. Diarrhoea and constipation are to be treated by the appropriate remedies.

Sleep, in this form of indigestion, is often improved by the nightly use of massage, and also by the application of a bag of hot water over the abdomen (Macfarlane).

THE INSOMNIA OF CYSTITIS.

Chronic cystitis produces obstinate and painful insomnia. This disease is a common consequence of enlarged prostate, calculus in the bladder, of gonorrhoea, and stricture of the urethra. Micturition is frequent, and attended with scalding pain; the urine contains muco-pus, which adheres to the bottom of the vessel when turned upside down.

Sleep is interfered with both by the pain (which in chronic cases may, however, be absent) and by the frequent calls to urinate. The victim of cystitis and prostatitis is obliged to get up every hour or two

* Dujardin-Beaumetz, Therapeutic Gazette, January 15th, 1890.

(sometimes every half hour) in the night to make water, and the act of micturition is often attended with a tenesmus that is most distressing.

The treatment should aim at removal of the cause. If there is a stricture or enlarged prostate or stone in the bladder, the proper measures should be taken for their removal or relief. If the cause cannot be reached, recourse must be had to palliative remedies. Washing out the bladder every day, or twice a day, with warm water, to which some antiseptic is added, as Marchand's peroxide of hydrogen, carbolic acid, boric acid, thymol, is now recommended by the best authorities, and certainly often gives marked relief. I have known patients, who had been long sufferers from prostatic disease which made their nights wearisome and life a burden, able to obtain several hours of quiet sleep after irrigating the bladder with a little warm carbolic water. For this purpose the soft rubber catheter is very useful. These are of various makes. The Jacques French catheter, the Tiedmann, the Davidson, are those with which I am best acquainted. The peculiar merit of these instruments is that they may safely be left to the patient to be passed by himself. The catheter is first greased with a little eucalyptus vaseline and passed into the urethra, then carefully pushed along till the flow of urine by the distal end indicates that it is in the bladder. After emptying the bladder, the cannula of a little hand-ball syringe, which is filled

with the antiseptic solution, is introduced into the mouth of the catheter and the contents injected into the bladder; the solution is then allowed to run out, and more is injected till the water flows off clean and free from mucus.

Too much pains cannot be taken to have the catheter always clean and aseptic; obstinate cystitis has been more than once started by the use of a foul catheter.

Suppositories of morphia, of opium, of hyoscyamus, etc., are often advantageous. The following prescription is frequently employed in the Jefferson Medical College Hospital of Philadelphia:

R Pulv. opil. gr. xij.
Camphoræ gr. xxx.
Ext. belladonna. gr. iij.
Cacao. q. s.

M. et in suppos. No. vi, divide.

S. One each night on retiring.

A teaspoonful of the tincture of hyoscyamus at bedtime sometimes proves to be a useful hypnotic in cystitis. The ordinary hypnotics (chloral, sulphonal, paraldehyd, urethan) are of little or no benefit.

INSOMNIA FROM GENITAL IRRITATION.

In this connection it is necessary to allude to the insomnia which attends genital irritation. While excess in venery sometimes causes insomnia by impairing nervous tone, there is another frequent

cause in individuals otherwise healthy, viz., continence. Every physician is now and then consulted by vigorous young men who have at some time given loose reins to their passions, and who afterwards in consequence of prolonged continence have troublesome erections at night which waken them and keep them awake. In such cases, in the event of the physiological satisfaction of an imperative want being impracticable, recourse must be had to sedative medicines, to anaphrodisiacs.

The suppository of camphor and opium (see above) may be given to advantage, or a full dose of chloral, or of bromide, has a great reputation in insomnia due to genital irritation. It should be given in large doses and followed up for some time.

R	Pot. bromide.....	3 iv.
	Tinct. hyoscyami.....	3 ss.
	Mist camph.....	3 vss.

M. Sig. A tablespoonful three times a day and at bed time.

Lupulin, which may be given in drachm doses stirred into a small cup of hot water at bedtime, is of ancient repute, and the same may be said of full doses of camphor.

Not much can be said in favor of cold douches to the perineum, which would be likely to aggravate the trouble.

The patient should sleep on a hard mattress, not on feathers, and should accustom himself to sleep with very few bedclothes over him.

The utility of avoiding romances of a certain character as well as everything else that can stimulate the sexual passion (and under this head come tobacco and alcohol) is sufficiently obvious.

INSOMNIA OF TOXIC ORIGIN.

The natural effect of alcohol on the cerebral functions is to impair healthful sleep. It excites the cerebrum by increasing the heart's action and the blood-flow, and by directly stimulating the cortical cells concerned in conscious activity. This is the ordinary action of alcohol when taken moderately, the effects of liquors being, as a rule, the less baneful the less impurities they contain, and the nearer they approach by rectification or by age to the type of pure ethyl alcohol.

It is possible that the stimulant effect of the alcohol on the stomach, rendering that organ hyperæmic, may sometimes promote sleep by temporarily anæmiating the brain. On the whole, however, alcohol is a most unsatisfactory hypnotic, and the sleep which attends its ingestion is generally brief, and followed by a period of wakefulness later on.

It is by no means proved that alcohol in any form ever fulfils the prime requisite of a hypnotic, that of lessening the amount of blood in the brain. The stupor which follows small medicinal doses is regarded by many authorities as a minor degree of that narcosis which comes on after excess. Into this

narcotism enter as factors the toxic effects of the alcohol on the cerebrum, vaso-motor paresis, and the paralyzing action of blood poisoned by carbonic acid, whose retention is due to interference with the respiratory function. Jaillet, moreover, has shown that the blood globule, when impregnated with alcohol, loses the property of transforming all its hæmoglobin into oxyhæmoglobin; for the oxygen of respiration unites at the same time with the alcohol and the hæmoglobin of the corpuscles; in other words, the alcoholized blood becomes too poor in oxygen to properly subserve either the nutrition or function of the cerebral cells. These considerations show how complex is the action of alcohol on the brain, and the necessity of caution in prescribing it in derangements of sleep. Certainly the continued use of alcoholic stimulants, even in moderate doses, for hypnotic effect, is likely to defeat the purpose for which the remedy is given, by producing in the end a very obstinate insomnia, if we can trust some recent authorities; and this it does by inducing a permanent loss of tone in the cerebral blood-vessels, if not by favoring arterio-sclerosis. "The effect of alcohol on the brain," says B. W. Richardson, "is to produce and maintain the relaxation of its vessels, to keep them charged with blood, and so hold back the natural repose. Under this divergence from natural life, the sleepless man lies struggling with unruly and unconnected trains of thought. . . . The more he tries,

the less he succeeds, till the morning dawns." Richardson affirms that arterial atheroma is a frequent consequence of even moderate indulgence in alcoholic beverages, and doubtless there is much testimony in support of this contention. As for the effects of long continued intemperance, there is no doubt that this is one of the most prolific sources of arterial degeneration. Nor is even beer exempt from harm of the same kind, and there is warrant for the belief that "the use of beer in many instances produces a species of degeneration of all the organs, profound and deceptive fatty deposits, diminished circulation, conditions of congestion and perversion of functional activities; local inflammations of both liver and kidneys are always present." Intellectually, a stupor amounting almost to paralysis arrests the reason, changing all the higher faculties into a mere animalism, sensual, selfish, sluggish, varied only with paroxysms of anger that are senseless and brutal. A writer in the *Scientific American*, who makes this assertion, claims a wide observation of the effects of beer-drinking among the various civilized nations.

But the point which we wish here to emphasize is, that the moderate use of alcohol in any form may produce insomnia by its exciting action on the heart and circulation, and on the cerebral cells; that the use of it as a hypnotic may, in the long run, defeat the end for which it is given; and that prolonged, immoderate indulgence, even in the milder intoxicant beverage,

ages, may produce grave cerebral disturbances and such as are incompatible with healthful sleep.

The remedy for alcoholic insomnia is that of alcoholism in general—the most complete abstinence from the toxic cause. Prolonged mental rest, the natural vaso-motor tonics, out-door air, massage, invigorating exercise, cold bathing, and perhaps sea-bathing, are indicated, and a nutritious diet adapted to the enfeebled state of the digestive organs. These patients are often benefited by a prolonged course of strychnia. One-thirtieth of a grain may be given three times a day, or ten drops tincture of nux vomica, just before meals. Hypnotics will be temporarily needed—chloral or paraldehyd. The combination of twenty grains of chloral with twenty drops of tincture of capsicum, in two fluid ounces of chloroform water, is a good one.

Physicians are seldom called upon to treat insomnia due to tea-drinking or coffee-drinking. The number of those who abuse these beverages is probably small, and the congenitally feeble and neuropathic early learn by experience to indulge sparingly in them. The tea-drinking malady is characterized by "sleeplessness or sleep disturbed by dreams or nightmare, headache, irritability of temper, depression, hypochondriasis, disorders of special senses, auditory and visual disturbances, neurosal palpitation, dyspepsia, intestinal torpor (with the accompanying flatulence and constipation), neuralgia, muscular enfeeblement and tremor." (Macfarlane.)

Insomnia is a frequent consequence of excesses in the use of tobacco. This is brought about, partly, by the digestive and circulatory troubles which characterize chronic nicotinism.

But the nervous centres are most violently smitten, especially the medulla oblongata, whence the cardiac, circulatory, and respiratory disturbances. The direct excitant influence of nicotine on the cortical centres is considerable; the existence of vaso-motor paresis is undoubted.

Entire abstinence is the only remedy; the poison is quickly eliminated. It has been found that the wakefulness is lessened by four-gramme doses of monobromide of camphor at night (Macfarlane), but any of the milder hypnotics may be administered.

The only other toxic agent necessary to allude to is opium. Opium and morphine may almost be said not to deserve a place among true hypnotics, so little do they bring about the conditions of normal sleep. It is known that they render the cerebrum hyperæmic; they paralyze the vaso-motors, and act upon the nerves which supply the respiratory muscles so as to interfere with the process of respiration (W. A. Hammond); hence the sleep which results from their use is more like stupor than natural sleep.

A most obstinate and unmanageable insomnia attends the opium or morphine habit, for the cure of which special treatment is necessary (especially in aggravated cases), and, generally, isolation in an insti-

tution possessed of properly trained nurses, and where restraint can be exercised.

The literature of morphinism is now quite extensive; prominent among works devoted to this subject are two treatises lately published, one by Regnier, the other by Oscar Jennings.

In breaking off the habit, Jennings declares in favor of the gradual method; and in conjunction with Professor Ball he has made some careful experiments on the power of sparteine and nitro-glycerin to combat the circulatory disturbances which attend the period of amorphinism.

INSOMNIA OF CONTINUED FEVERS AND ITS TREATMENT.

In typhus and typhoid fever, sleeplessness is a frequent, troublesome, and often dangerous symptom. Dr. Murchison, writing of the necessity of sleep in typhus, says: "The practitioner cannot be too forcibly impressed with the fact that loss of sleep at any stage of typhus, if it continue for two or three nights, is of itself sufficient to kill."

In typhoid the necessity of sleep is no less urgent. One of the first symptoms of approaching dissolution is a restlessness which forbids sleep, and the return of refreshing sleep is hailed by physicians and attendants as a presage of recovery.

In the earlier stages of these fevers, insomnia is pretty certain to accompany the hyperthermia, while

sleep often attends a fall in the temperature. It would seem that over-heated blood is itself inimical to sleep by exciting the cerebrum. Certain it is that cold bathing—the cold or tepid bath—and antipyretics that bring down the fever quiet the nervous disturbances and promote sleep. Hence, for the restlessness and insomnia of typhus and typhoid fevers, there is often no better treatment than a cold bath of about fifteen minutes' duration, the temperature of the water being from 60° to 75° F., and during the bath cold water may be poured on the head in cases of extreme pyrexia with restlessness and delirium. While fifteen minutes ought to be long enough to depress the febrile heat to nearly the normal, in some cases the bath may be of longer duration. "The earlier the stage, the higher the fever, the more robust the constitution, the colder should the water be. The later the stage, the weaker the constitution, the more affected the nervous system, the warmer should be the water." *

Some writers claim to have found cold sponging and the wet-pack a sufficient substitute for the cold bath. Others have derived only a temporary refreshing from these milder means.

Where the cold bath is impracticable, from difficulties on the part of the patient or his surroundings, some one of the new antipyretics may be tried. There

*J. C. Wilson.

is much testimony in favor of acetanilid as a nervous sedative in fevers. Five grains every hour for three or four doses (in an adult) will generally lower the febrile temperature two or three degrees, and one or two hours of quiet sleep (especially if the medicine be given in the night-time) is almost certain to follow. By many practitioners and hospital physicians, analgesin is regarded as the preferable hypnotic; the dose should be double that of acetanilid.

These antipyretics, though they undoubtedly have a marked action on the thermogenetic and thermotaxic heat-centres, which are under abnormal irritation by the fever-poison, an action which is extended to the higher cerebral centres, certainly do not affect the infectious agent, and hence the course of the fever is not influenced by them. Their prolonged use is probably attended by some cardiac depression (an evil to be especially shunned in fevers), and the best clinical authorities are shy of them, seeing no permanent advantage in the continued administration of these medicaments, but possibly mischief. At the most, their employment is restricted to the obtaining of such sedation as is needed for the nervous disturbances.

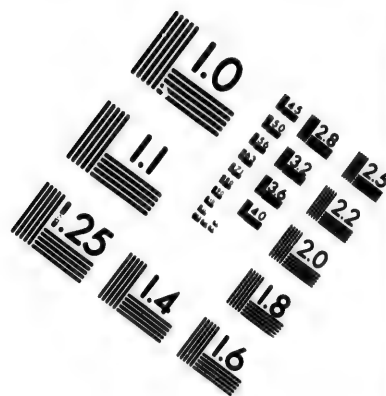
Among the pure hypnotics, chloral still deservedly takes the lead in the treatment of the insomnia of fevers. It calms the delirium, saves the forces, moderates the fever, and produces a sleep strikingly like natural sleep in its refreshing effects (Liebreich,

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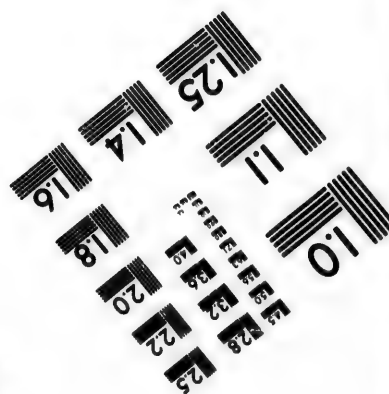




Resolution test chart showing various line patterns and numerical values:

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- 1.25
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Nothnagel, Flint, Russell, Dujardin-Beaumetz). The only contra-indication is cardiac weakness. In the latter stages of typhus and typhoid it is better to avoid chloral, substituting opium or morphine, and in the earlier stages, where there is much jactitation and delirium, and especially when diarrhoea is a prominent symptom, 20 drops at bedtime of the deodorized tincture of opium in a little camphor-water is a useful adjunct to other measures intended to subdue restlessness and produce sleep.

With regard to sulphonal, we think that experience has proved this hypnotic to be of little utility in the obstinate insomnia of fevers, and the same may be said of chloralamid and other of the more recent hypnotics. Paraldehyd, were the taste not so objectionable, might render considerable service in the delirious insomnia of typhus.

Alcoholic stimulants judiciously administered sustain the heart and circulation, promote the nutrition and restoration of the nervous system, and thus come under the head of remedies useful to combat insomnia. Given in too large or too frequent doses, they undoubtedly defeat the end for which they are given, and aggravate existing nervous disturbances. There is another reservation,—they must be cautiously prescribed where there is renal insufficiency.

Stokes, in his lectures, speaks of the well-marked calming and sedative effect of wine in fever. "A patient who has been restless, sleepless, and delirious

will sometimes become quiet and fall asleep after the administration of a little wine. This occurs where the nervous symptoms are probably due to an anæmic or spanæmic condition of the brain associated with a weak heart and a flagging circulation."*

Febrile insomnia is essentially a toxic insomnia; this has been made apparent by the investigations of the last few years. Whether it be the microbes or their ptomaines, or both, which excite the cerebrum and derange the nervous functions, has not been yet positively determined. Uræmia probably enters as an important factor; in the active stages of fevers, and in the declining stages when the circulation is oppressed and languid, and the prognosis is grave, elimination by the kidneys is always imperfect. Hence an important part of the treatment should be to promote the excretion of the poison and the removal of effete matters. Unfortunately, this indication can be but imperfectly met. All that can be done is by suitable nutrients and stimulants to sustain the organic forces in their struggle with the foe, and to favor elimination by the kidneys and other emunctories. The various diluents (lemonade, barley-water, effervescent drinks, plain water, etc.) which are so freely given, because so constantly craved, promote excretion by the kidneys. Milk is often prescribed *ad libitum* as the sole drink and nourishment; its di-

* "Lectures on Fever," Lea Brothers & Co., 1876.

uretic properties are well known. Some clinical authorities are in the habit of ordering mild diuretic mixtures (solutions of nitrate of potassium, of sweet spirits of nitre, with sometimes the addition for several successive days of a little digitalis) all through the fever, and claim good results.

The bowels should be kept open, suitable mild laxatives being given if there be constipation, and frequent cold or tepid ablutions, followed by brisk rubbing, will do something towards promoting the functions of the skin.

We have hinted at anæmia and spanæmia as being part causes of the insomnia of continued fevers. Emphasize as we may the poisoned condition of the blood and the abnormalities of the circulation, the fundamental factor in the insomnia, headache, jactitation, delirium, and hebetude of continued fever is malnutrition of the highest nerve-centres, and against this our therapeutic resources are meagre. The necessity of nourishment is apparent; but little food, however, can be assimilated; and, in the absence of any specific medication (for which the profession is looking), the best that can be done is judiciously to combat dangerous symptoms. The insomnia is the measure of the cerebral disturbance, and, if this can be successfully overcome, one important obstacle at least in the way of recovery is removed.

* * * * *

[*Chapters on syphilis, rheumatism, gout, and lith-*

æmia, as producers of insomnia, were originally drafted, but it was found impossible to include them without making this volume too bulky. A treatise on all the causes of the derangements of sleep would comprehend almost the whole of internal, and even surgical pathology.]

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CHAPTER III.

HYPNOTICS.

The limits of this treatise will allow of only a brief consideration of the leading agents that properly come under this head. I shall take up first the medicinal hypnotics, then the remedial agents not medicinal.

I. OPIUM AND NARCOTICS.

Opium is the most ancient and still the most universally employed hypnotic. The narcotic property of opium is the result of its morphine, codeine, papavarine, and cryptopine—all somniferous alkaloids. Opium is far from being a pure hypnotic; in small doses its action is that of an excitant of the cerebrum, and generally it is only in tolerably large doses that it is hypnotic. Many persons find opium, and especially morphine, powerful promoters of wakefulness, sleep only following many hours after the ingestion of the narcotic.

Opium is *par excellence* the hypnotic where the insomnia is due to pain. Opium undoubtedly exerts its power by a stupefying action on the cortical cells, rather than by any changes which it effects in the circulation. "It is the peculiar virtue of narcotics," says Stillé, "to blunt the senses and steep the mind in forgetfulness, in spite of pain, of nervous irritability, or of tormenting thoughts."

The combination of opium or morphine with the pure hypnotics, as chloral, sulphonal, paraldehyd, urethan, is often highly efficacious. The following formulæ are recommended: (These prescriptions are designed for adults only.)

CHLORAL AND MORPHIA.

R Morphinæ sulph. gr. ij.
Hyd. chloral. 3 ij.
Syrup tolu. 3 ij.

M. Sig.—A teaspoonful when needed to induce sleep.

PARALDEHYD AND TINCTURE OF OPIUM.

R Paraldehyd 3 l.
Tinct. opii deod. gtt. xx.

M. For one dose. To be taken in a little old rum and water. Valuable in the insomnia of melancholia, in delirium tremens, incipient paralytic dementia, etc.

SULPHONAL AND MORPHIA.

R Sulphonal 3 ss.
Morph. sulph. gr. ¼.

M. One powder, for a hypnotic effect where there is great nervous irritability or pain.

MORPHINE WITH CHLORAL AND BROMIDE OF SODIUM.

(From Macfarlane.)

R Liqui morphin acet. f 3 i.
Hyd. chloral. 3 i.
Bromid. sodii. 3 ij.
Syrup tolu. 3 iv.
Aquam add. 3 iv.

M. Sig.—Take one-fourth part in water before bedtime, and repeat in two hours if required.

Other narcotics—belladonna, hyoscyamus, Indian hemp, stramonium—have but feeble hypnotic power. They are not absolutely devoid of this power, as some writers have affirmed, but they are not to be depended on.

In insomnia due to genital irritation (such cases as sometimes come before the notice of the physician in connection with habits of masturbation and attempts at reformation, or in continent young men who are kept awake by troublesome erections), also in the insomnia produced by gonorrhœal chordee, hyoscyamus is often of real efficacy. The camphor and hyoscyamus pill is a convenient formula:

℞ Pulv. camph..... gr. i.
Ext. hyoscyam..... gr. liij.

M. For one pill. To be taken at bedtime. A suppository of ext. hyoscyamus, 3 grains, and pulv. opii 1 grain, with cacao butter, may be often used to advantage.

In chordee, I have given teaspoonful doses of tincture of hyoscyamus three times a day without producing any troublesome dryness of the mouth and throat or dilatation of the pupils, and seen quiescence and sleep follow.

Lettuce and hops possess true hypnotic virtues, with mildly stupefying properties, and do not produce any arterial or cerebral excitement or delirium, or any subsequent paralysis of nervous or muscular function like other narcotic agents, and particularly opium and belladonna; they act in this respect more like chloral

and paraldehyd than like opium, engendering a calm which soon passes into natural sleep.

I know certain aged patients who sleep poorly in consequence of cerebral arterial degeneration, but who affirm that when they are able to indulge freely in lettuce as an article of diet, they sleep very well. I have not, however, seen the least hypnotic benefit from any pharmaceutical preparation said to contain lettuce.

HOPS-LUPULIN.

I have known simple insomnia from neurasthenia, from care, worry, overwork, etc., temporarily relieved by teaspoonful doses of lupulin on retiring. I say temporarily, for I have never known the effect to last longer than two or three nights. The doses must be rather large. Hop tea can be of little use, as hops do not yield their active principle to water. Lupulin is a yellow powder formed on the surface of the scales of hops; it is obtained by rubbing or threshing or sifting the strobiles, of which it constitutes from one-sixth to one-tenth by weight. It contains a volatile oil and bitter principle which are readily soluble in alcohol. Lupulin may be given in pill form, or be taken in the form of a paste, mixed with water or syrup.

Doubtless in cases of insomnia from irritable bladder, and from genital irritation, nearly all practitioners have occasionally found lupulin in teaspoonful doses useful.

It will not do in closing this topic to omit to mention the hop pillow, which has sometimes proved beneficial in allaying restlessness and producing sleep in nervous disorders. The pillow should be moistened with spirits before being placed under the head of the patient (Dr. Geo. B. Wood).

Pills for Satyriasis (Dujardin-Beaumetz).

Lupulin..... 2 grammes.

Bromide potassium..... 2 grammes.

Ext. nymphaea (water lily). q. s.

For 20 pills. Sig. Take two pills every two hours.

II. ALCOHOL, AND OTHER STIMULANTS—EUPEPTIC AGENTS.

Alcohol sometimes acts as a hypnotic, and is in fact frequently resorted to for that purpose. It produces sleep, not because it is a vascular stimulant, clearing the over distended blood-vessels, but because it is taken in a sufficient dose to have a narcotic effect. Ale is especially chosen for hypnotic effect; the hops with which it is impregnated undoubtedly aid the calmative action. Whiskey or brandy to have a soporific effect should be of pure quality, and the older the better. The theory that liquors long mellowing in the cask get rid of fusel oil and other alcohols not ethylic, and develop soothing ethers, seems actually sustained by facts; certain it is, moreover, that new liquors adulterated with the higher atomic and more fiery alcohols are excitant, and therefore antagonistic of

sleep. A tablespoonful or two of pure whiskey taken on going to bed will often relieve the insomnia of the exhausted, the irritable, the nervous; the insomnia due to mental overwork or worry will often promptly yield to the alcoholic potion. It is well to administer the spirit in a tumbler of hot water—as hot as can be drunk—as the heat favorably excites the stomach, and through that organ reflexly soothes and inhibits the cerebrum.

Unfortunately, the sleep produced by alcohol is often of short duration; the patient awakes after a couple of hours but little refreshed, and may lie awake much of the night without being able to go to sleep again. The combination of whiskey with a little sulphonal may, however, remedy this. The sulphonal may first be taken in fine powder, well stirred, till it is about the thickness of cream, into a little water; this is followed by the draught of whiskey. When the effects of the alcohol begin to subside, those of the sulphonal (which is slow to undergo absorption) are just commencing. I have known a dose of only 10 grains of sulphonal, followed by a tablespoonful of old whiskey in a little hot sweetened water, to be succeeded by eight hours of sound sleep.

Ginger, peppermint, camphor, lavender, cardamom, and other gastro-intestinal stimulants and "carminatives," taken with hot water, occasionally prove hypnotic. Even hot water alone may induce sleep if drunk freely on going to bed; in such cases

it may be supposed that the insomnia is the result of a dyspeptic state, and that the increased vascularization of the stomach may cause diminished vascularization of the brain, thus producing one of the conditions of sleep. A few drops of the aromatic spirits of ammonia, of the ammoniated tincture of valerian, of the fluid extract of skullcap, will sometimes enable the individual speedily to pass the barrier which separates the waking from the sleeping state. Many a person rendered sleepless by a disordered stomach—the seat of acrid fermentations—has been enabled to realize immediate quiescence of both stomach and brain by a dose of rhubarb and soda, a drachm of Carlsbad salt in a cup of hot water, or even the same quantity of bicarbonate of sodium taken in the same way.

III. BROMIDE OF POTASSIUM AND BROMIDES.

Among the newer hypnotics must be mentioned bromide of potassium, which still has a great reputation as a remedy for chronic insomnia. It probably produces its effects, as Vulpian taught, not by anæmiating the cortex,* but by the influence which it directly exerts on the anatomical elements. "It simply lessens the functional activity of the brain, without disturbing the relation of one part to another" (Brunton). Where the indication is to diminish cerebral or spinal irritability; where the brain is hyperæmic from excess

**Leçons sur les Vaso-moteurs*, t. II, chap. I.

of mental toil, from prolonged watching, from abuse of stimulants; in nervous erethism characterized by emotional excitability, exaggeration of the reflex activity; in the insomnia of fevers, and in genito-urinary insomnia, bromide of potassium (at least till the discovery of chloral) has been the best hypnotic known to the profession. It depresses innervation generally, and is a debilitant of the heart; hence, in the feeble, asthenic, and cardiac, it is to be prescribed with caution. It may often with advantage be associated with chloral and morphine; if given with whiskey its depressant action is less marked; the combination with calisaya, with simple elixir, with anise cordial, makes it often more acceptable to the stomach.

R Pot. brom. grs. xxx.
Anise cordial ℥ i.

M. For one dose.

R Pot. bromid. ℥ ss.
Elix. calisaya, } ℥ iiij.
Sherry wine, }

M. Sig.: A teaspoonful three times a day and at bedtime.

R Pot. bromid., } ℥ iiij.
Hyd. chloral, }
Tinct. valerian. 3 vi.
Spts. lavend. co. 3 vi.
Aqua camph. q. s. ad 3 vi.

M. Sig.: A tablespoonful every two hours till sleep is induced.

The above formula has been of great use to me in the treatment of alcoholic insomnia.

BROMIDE OF LITHIUM.

The bromide of lithium, according to Macfarlane, is the best hypnotic of the bromide salts, as it contains a half more bromine than the potassium bromide. Its dose is 10 to 20 grammes. Macfarlane recommends the combination with ergot of rye and digitalis, both of which are stimulants of the vasomotor centres.

R Bromidi lithii..... grs. xl.
 Fluid ext. ergot..... ʒi.
 Tinct. digitalis..... ℥ xx.
 Chloroform water..... ʒ xv.

M. Sig.: Take one-half two hours before going to bed, and the other half at bed-time.*

IV. CHLORAL.

The discovery by Liebreich, in 1869, of the hypnotic properties of hydrate of chloral may be regarded as one of the most important therapeutic discoveries of modern times. The experience of the past twenty-two years has more than justified the first conclusions respecting its actions and uses, and chloral may still be regarded as, on the whole, the best hypnotic we possess. Its principal advantages are: 1. It is speedy and generally certain in its action. 2. There is no preliminary period of excitement. 3. Its effects are prolonged, and the sleep which it produces is calm, tranquil, and refreshing; the patient wakes out of the

* Insomnia and Its Therapeutics, p. 88.
 7 222

chloral sleep as out of natural sleep. 4. It can be given with good results in cases where opium is not tolerated. 5. There are seldom any unpleasant or injurious after-effects; it does not disturb the secretions or excretions, as do many other hypnotics. 6. It has a wide range of usefulness besides being simply a sleep-producer; in all morbid cerebro-spinal conditions attended with excitation, delirium, or spasm, it is markedly beneficial; in the insomnia due to delirium tremens, acute mania, general paralysis of the insane, puerperal mania, chorea, tetanus, etc., it is of great value.

Among its disadvantages are: 1. It is a cardiac depressant, and therefore must be given with great caution, or withheld in organic affections of the heart. 2. It is a dangerous remedy when long-continued, its effects on the brain, and consequently on the mental functions and disposition, being deplorable. The *chloral habit* is, doubtless, quite as bad as the morphine habit. "Its employment," says Macfarlane, "is so fraught with risk that its use, except under medical advice, is much to be deprecated.

"At first the mental depression and melancholia, from which the patient suffers, are alleviated by a dose of the drug; after a time it fails to soothe, and may even excite. The victim gravitates into a pitiable state of mental weakness and demoralization, becoming childish, vacillating and untruthful, sometimes dejected, at other times excited, and having

and almost everybody has experienced the difficulty of going to sleep when the feet are cold.*

The Wet Pack.—This is a very active hydrotherapeutic method, being a "derivative or calmative of the highest order" (Macfarlane).† A sheet is wrung out of cold water, and the patient is enveloped in it from neck to ankles, the head and feet not being included. Several dry blankets are wrapped around the patient, a hot water bag is applied to the feet, a cold wet cloth to the forehead, and the patient is allowed to remain in the pack from half an hour to an hour. At the end of the process he is rubbed down with dry cloths to promote vigorous reaction.

The Turkish Bath.—The Turkish bath is highly recommended in many cases of insomnia. It relieves cerebral congestion, and promotes circulation and

*Hammond employed with success, in a young girl whose extremities were habitually cold, electrization of the sciatic nerve.

†Experiments of Weir Mitchell have shown that the effect of chilling the cerebrum is a brief sedative action. Then phenomena of motor excitation are developed, sensibility is lessened, and if the application of cold is continued, the animal falls into a profound stupor, and surgical operations may be performed on him without the least movement. When cold is applied to the medulla oblongata, the respiratory movements are first tumultuous, then they are slowed, and finally cease altogether. (Quoted from "Clinical Therapeutics," by Dujardin-Beaumont. Published by G. S. Davis, Detroit, Mich.)

arterial tone, as well as digestion and assimilation. The Turkish bath consists of three rooms. The temperature of the first, or dressing room, is moderate, that of the second is higher, that of the third is higher still. In the first room, the bather, after dressing, winds one towel around his loins and a second around his head in the form of a turban. If he has any tendency to cerebral congestion, the second one may be wet. He then passes into the second room, where he waits a short time before passing into the third room. Some people, however, go directly into the third room. In both the second and third rooms the bathers partake freely of cold water. A few minutes' stay in the warmest room is usually sufficient to make the bather perspire freely, and he then returns to the second or cooler room, where he may remain half an hour or more, according to circumstances. He may then be shampooed, the surface of the body being rubbed, the muscles kneaded, and the smaller joints extended. He is then washed with a lather of soap, and sluiced with basins of tepid or warm water. For some people it is most agreeable after this to be simply wrapped in warm towels and allowed to repose in the dressing-room. Others prefer to finish up with a cold douche before proceeding to the dressing-room. Here they remain resting for a considerable time before they again dress.*

* Brunton's Pharmacology and Materia Medica.

Hot Compresses, consisting of layers of flannels wrung out of hot water and covered with dry flannels, are sometimes of benefit in insomnia when applied over the abdomen.

In an interesting lecture recently published in the *Dietetic Gazette* (Dec., 1891), Dr. C. L. Dana, in speaking of the benefits of hydrotherapy in nervous diseases, regards the wet pack as a most useful sedative in neurasthenia and insomnia, and a good substitute for medicinal sedatives, like the bromides. It should be given three or four times weekly, or for a short time daily. The tepid bath ranks next in its sedative efficacy. The *shower and jet baths* are a most valuable means for securing *tonic* effects.

In weak, sensitive and anæmic women, he prescribes, first, dry hot packs for a week, then wet packs, and, finally, the drip sheet or cool shower. The Turkish bath and the *hot Sitz* bath (the patient sitting for twenty to thirty minutes in water at blood heat) have also been found to have excellent sedative effects and to be promotive of sleep.

Electricity.—My experience, like that of most general practitioners, has been confined to faradism. I have resorted to this form of electricity for the relief of obstinate insomnia. I have never applied the current to the head, but have sought to obtain a powerful derivative effect by applications of the wet sponge, or the metallic brush, to distant parts of the body. I have seen neurasthenic patients quieted and

made able to sleep by faradization up and down the spine about bed-time; also by a general electric massage, given with the hand, which is made to communicate the current.

Stillé (Therapeutics and Materia Medica) speaks of obtaining success "by passing a fine secondary or primary current from the cervical vertebrae to the epigastrium, and from the dorsal vertebrae to the entire front of the chest." "Drowsiness," he adds, "is not uncommon in anæmic and debilitated persons during the use of a generally applied direct inductive current. It has occurred only under the influence of a fine interrupted current of the second order, with a low intensity. In old persons who are restless and sleep badly, a current of this kind passed over the forehead, while the negative is carried over the shoulders and down the arms, quickly promotes sound and prolonged sleep."

Doubtless cutaneous faradization produces that anæmic condition of the encephalon which is favorable to sleep; in confirmation of the view that this is the case, we have the observation of Nothnagel that "cutaneous electrical stimulation is followed by a reflex contraction of the vessels of the pia mater."

Central galvanization has proved efficacious in the experience of Berdet, Meyer, Erb, Skene, Keith, Macfarlane, and others. According to the experiments of Legros and Onimus, currents of descending direction (positive pole over the forehead, negative

pole to the neck) determine contraction of the vessels of the pia mater; reverse the poles, and a directly contrary effect is obtained.

Doubtless electro-therapeutists, by their ready control (through the proper currents) of the vaso-motors, are able to modify the intra-cranial circulation at will, and if sleep were only a circulatory phenomenon, they would be able to give us infallible recipes for all kinds of insomnia. Unfortunately the laws of natural sleep are not exactly the same as the laws of the vaso-motors: sleep is, as has before been said, something more than a plus or minus of blood in the brain. If galvanism is a remedy for insomnia, it is by improving the tone of the vessels, and the nutrition of the cerebral cells, rather than by any transient influence on the circulation, that it does good.

The subject is one on which a long chapter might be written, but such a chapter would be inappropriate for this treatise. The successful treatment of insomnia by galvanism presupposes, on the part of the practitioner, a knowledge of technical details and a skill which can only be acquired by a study of the best special treatises on electro-therapeutics and by long practice. Moreover, the range of usefulness of electricity in insomnia is largely limited to neuropathic or neurasthenic cases.

Lewandowski and Eulenburg state that they have obtained very favorable results with franklini-

zation. The head plate is used, and the electricity is conveyed in the form of breezy currents which are both agreeable and soothing to the patient. By means of the discharging hand electrode, the patient is also electrified through his clothes; the séances last about half an hour, and the patient goes to bed soothed and ready to go to sleep. At the Adams Nervine, Jamaica Plain, much account is made of static electricity in the treatment of nervous insomnia, and my friend Dr. B. W. Bartlett, of Rowley, informs me that he relies principally on this form of electricity (along with other hygienic means) in the treatment of neurasthenia and its accidents, insomnia included.

To conclude the chapter on Hypnotics—if drugs have had the greatest prominence among the therapeutic means, it is not because they are really the most important. I think that physicians should be very chary in prescribing the medicinal hypnotics. We still know too little about their action on the delicate cells of the brain and on the vaso-motors. Many of them, by constant or frequent use, become positively baneful. It is, therefore, with a caution against the careless employment of hypnotics that I close this book, and with an exhortation to physicians first to try fully (when possible) all available hygienic resources before resorting to medicinal hypnotics.

INSOMNIA.

SLEEP, poetically expressed, is "Life's nurse sent from Heaven to create us anew from day to day." It is, indeed, "Tired Nature's sweet restorer."

Insomnia may be dependent upon derangement of the nervous, circulatory, respiratory or urinary organs, the alimentary tract, the liver, or upon febrile or general disease. It may also be caused by unhygienic conditions of heating, lighting, ventilation, diet, or occupation.

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